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PROCEEDINGS
OF THE
COTTESWOLD NATURALISTS'
FIELD CLUB.

VOLUME III.

*Plates to v. 3
bound
separately.*

Gloucester:
PRINTED BY JOHN BELLOWES, WESTGATE STREET.

1865.

PALAEONTOLOGY

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Notes on the Ammonites of the Sands intermediate the Upper Lias and Inferior Oolite. By JOHN LYCETT, M.D.

THE annual presidential address to the Cotteswold Naturalists' Club, 1860, p. 184, comments upon the Fossils of the Sands intermediate the Inferior Oolite and Lias, and contains remarks which have induced me to offer the following notes illustrative of the Ammonites contained in these sands, and intended to afford a concise analytic examination of their natural history, characters, and geological distribution. It has hitherto been generally considered that they all belong to the Upper Lias, by which term is usually understood in this county all the shales, clays, and argillaceous sandstones (the Lias Epsilon of Quenstedt), superimposed upon the Middle Lias, or Marlstone, and beneath the sands which for the most part underlie the Inferior Oolite in England. The following facts will, however, probably be considered very much to modify this view, and to show that a large proportion of these Ammonites have no connection with the *Lias Epsilon*, but are special to the sands, also, that three of them are boundary species, and have only a very limited vertical range, occurring at the junction of Sands with the Upper Lias (*e*), the others at the upper boundary of the sands, and appearing at some foreign localities as species of Inferior Oolite, but in England as species of the Sands. The establishment of these facts will also tend materially to remove an apparent discordance which appears to exist between the Cephalopoda and Conchifera of the Sands, the former being supposed to be exclusively Liassic, the latter consisting of Inferior Oolite and special forms, together with a very small minority of Liassic, the latter also passing upwards only to the lowest fossiliferous zone of the Sands. The following table has been drawn up to shew the vertical range of the Ammonites of the Sands, excluding those which are special to the Lias beneath them.

	Upper Lias.	Sands.			Inferior Oolite.
		Lower.	Middle.	Upper.	
<i>Ammonites opalinus</i>	■	
* ————— <i>dispersus</i>	■	
* ————— <i>Aalensis</i>	■	
————— <i>discoides</i>	■	
————— <i>serrodens</i>	■	
————— <i>Comensis</i>	■	
————— <i>Hircinus</i>	■	
————— <i>Leckenbyi</i>	■	
————— <i>Boulbiensis</i>	■	■	■	■	
————— <i>Jurensis</i>	■	■	■	■	
* ————— <i>radians</i>	■	■	■	■	
————— <i>insignis</i> (2 varieties)	■	■	■	■	
* ————— <i>striatulus</i>	■	■	■	■	
————— <i>variabilis</i>	■	■			
————— <i>fimbriatus</i>	■	■			
* ————— <i>crassus</i>	■	■			
* ————— <i>Ilminsterensis</i> ..	■	■			
————— <i>complanatus</i> ..	■	■			

The Sands have been divided into three portions as they contain three fossiliferous horizons at several localities in the Cotteswolds. The two species which are stated to pass upwards into the Inferior Oolite are given upon the authority of Professor Quenstedt and of Dr. Oppel, the former of whom has figured them (Jura, pl. 42 and 45) from the Brown Jura 'a' of Wurtemberg, in England they have not been found higher than the Sands.

It will be perceived from the foregoing table that of the thirteen *Ammonites* found in the upper portion of the Sands at Frocester Hill, and other localities, eight do not pass downwards to the Lias, nor lower than the highest bed of the Sands; that the other five occur throughout the Sands, and also in the upper Lias; and that the remaining five species of the lower Sands are also Liassic, but do not pass upwards into the Sands higher than the lowest fossiliferous band near to their base. All the *Ammonites* of the lowest zone in the Sands are therefore Liassic, but one of them (*A. variabilis*) is a boundary species, and passes downwards into the Upper Lias only a few inches, as will be found in the sands on the coast of Yorkshire, at Ilminster, at Nailsworth in the Cotteswolds, and in France. Of the *Ammonites* in the Upper Sands two are also boundary species, they have been found rarely very near to the upper boundary of the Sands at Frocester Hill, one of them (*A. opalinus*) has also occurred in the same position at Burton Bradstock, Somerset, and at Blue Wick on the Yorkshire coast. In Wurtemberg, on the other hand, both species occur

* These species occur abundantly in the Cotteswolds.

only above the Sands in black clays and shales, associated with a fauna which is to a great extent local and peculiar. Of the Ammonites of the Upper Sands *A. dispansus* and *A. Aalensis*, two of the more common forms, are not Liassic, the former more especially probably equals in its numbers all the other Ammonites at Frocester Hill. I will now proceed to offer some remarks upon the Ammonites, seriatim, and in the order in which they appear in the table.

Ammonites opalinus, Reinecke. This is one of the more rare forms of the genus in England, where it occurs only at the upper boundary of the Sands; in Wurtemberg, fragments of it are stated to occur in immense numbers at a somewhat higher position at many localities.

Ammonites dispansus, Lycett. This was long confounded with *A. variabilis*, and it has only been after a comparison of very numerous specimens of both species, and of all stages of growth, that it has been found necessary to separate them; their geological position is also quite distinct, *A. dispansus* occurs only in the Upper Sands, *A. variabilis* does not pass higher than the lowest fossiliferous bed of the Sands, both are very limited in their vertical range and never occupy the same horizon. Both in the young and adult conditions of growth *A. dispansus* is always more discoidal than the other, the figure of the back more especially differs in its acute keel, the tubercles upon the inner margin of the volutions are much more faintly marked, and unlike those of *A. variabilis* they are irregular, they give origin to numerous fasciated delicate sigmoidal radii; in *A. variabilis* the radii constitute rigid, nearly straight, and comparatively prominent ribs, the septa in *A. dispansus* have the lobes much more simple, less pointed, and less produced, the test is preserved very rarely and only in young specimens, it is delicate and exhibits the fine hair like sigmoidal radii much more distinctly than the casts. Specimens and fragments are very abundant at Frocester Hill, at Haresfield Hill they are present but are badly preserved. The largest specimen in my possession is $5\frac{1}{2}$ inches across, but very few exceed 3 inches.

Ammonites Aalensis, Zieten. Perhaps none other of the group of the Falciferi exhibits so great an amount of variability in the ornamentation of the surface as this species does, for the most part the varieties upon which its synonyms are founded have each a distinctive character, and their names may be retained for as many true varieties. It has only been after the acquisition of a multitude of examples that I have ventured to arrive at this conclusion, and to select the thirty specimens on the tray before me to illustrate all these varieties, for which purpose a smaller number would but inadequately illustrate them. Two of these synonyms, *Ammonites comptus*, Rein., and *A. costula*, Rein., have priority, but as the former is only a young tumid abnormal variety, and the latter a rare

and very inconstant variety, it will be preferable to adopt Zieten's well-known name *A. Aalensis*, which represents the typical form though not an adult one. D'Orbigny's figures of *A. Aalensis* represent the aged and young conditions of the typical form, his figures of the septa are more complicated and the lobes more produced than is usually seen even in old shells. The first three or four volutions have large, elevated, nearly straight, sometimes fasciated ribs, which gradually become less conspicuous until they are not distinguishable from the faintly marked folds of growth, in old specimens these costated volutions are nearly concealed by those succeeding, which are almost plain.

The second variety "*Costula*," *Ammonites costula*, Reinecke, *A. Aalensis costula*, Quenstedt, *A. Acteon*, d'Orb. (?) is usually more tumid than the typical form, and has narrow, curved, distant, and nearly regular costæ, which disappear towards the keel; in the adult state the costæ become irregular, and gradually disappear. This is a small rare variety.

The third variety "*Regularis*," *Ammonites regularis*, Simpson, from the sands at Blue Wick, and from Frocester Hill, is also a small variety, and more tumid than the typical form; it has acute elevated curved radii much more closely arranged than in *costula*, and in some instances they are nearly regular and equal for an entire volution, in other instances the costæ are less conspicuous and more unequal, but they are scarcely fasciated, it is comparatively rare. Simpson places this form in the Middle Lias, which is an error, as I have ascertained from comparing the original specimen in the Scarborough Museum with other examples from Blue Wick.

The fourth variety "*Comptus*," *Ammonites comptus*, Reinecke, is distinguished in the young state by fine closely arranged sigmoidal radii, which are fasciated at occasional intervals by folds of growth, subsequently they are not fasciated and gradually disappear; Reinecke's figure represents the young condition of this variety which accompanies the other varieties in the Upper bed of the Sands at Frocester Hill.

The fifth and largest variety "*Moorei*," *Ammonites Moorei*, Lycett, figured and described in my little work, "*The Cotteswold Hills*," is more nearly allied to *comptus* than to the other varieties in the characters of its radii, which, however, are not fasciated, they are very fine, acute, but not altogether regular or equal; in large specimens more than half of the last volution is destitute of ornament. A comparison of Zieten's figure of *A. Aalensis* with that of *A. Moorei* will form my best excuse for having in the first instance failed to discover the affinity of the two forms; their dissimilarity is indeed so great that it will require some faith in the foregoing statements to realize the idea of their specific unity in the absence of a good series of connecting specimens. The varieties of *A. Aalensis* may therefore be arranged into the following groups,

disregarding the intermediate and connecting links, some of which form an absolute passage from the one to the other.

- AMMONITES AALENSIS. 1. *Aalensis*, A. Aalensis, Zieten.
 2. *costula*, A. costula, Reinecks.
 3. *regularis*, A. regularis, Simpson.
 4. *comptus*, A. comptus, Reinecks.
 5. *Moorei*, A. Moorei, Lycett.

Ammonites discoides, Zieten. The most discoidal and also one of the most rare of the Frocester Hill species.

Ammonites serrodens, Quenstedt, *A. inornatus*, Williamson, was briefly described, but not figured by Professor Williamson in his well-known memoir on the distribution of fossils on the coast of Yorkshire; specimens of this rare form are in the Scarborough Museum, and in the collection of J. Leckenby, Esq., of the same place, these are from the sands of Blue Wick; I also possess a single specimen from the upper bed of the Sands at Frocester Hill; it is sometimes upwards of a foot across, and not altogether destitute of ornamentation, the younger specimens having some broad depressed and obscure radii, in adult forms the lobes are much more produced than in the figures given by Quenstedt.

Ammonites Comensis, Buch, (variety). A single aged but fine example from the Upper Sands at Newmarket, near Nailsworth, is my authority, the more advanced stage of growth will account for its large dimensions when compared with the figures of Von Buch and Hauer; at the utmost, however, it can only be regarded as a variety of *Comensis* with a few large nodose swellings upon the inner border of the volutions, and large falciform costae, three or four to each swelling, much more curved than in the authorities above quoted, a considerable proportion of the last volution is plain. The *Comensis* of d'Orbigny is the *striatulus* of Sowerby. In Wurtemberg it occurs in the same position in the Jurensis marls of Balingen.

Ammonites Hircinus, Schlotheim. Only portions of this remarkable Ammonite have hitherto been found at Frocester Hill; in Wurtemberg it occupies a similar position at Wasseraifingen and Heinengen; in France at Verpilliere (Isère).

Ammonites Leckenbyi, Lyc., very rarely at Frocester Hill in the form of casts, the test has probably radiating striations; one of the examples of *A. torulosus* figured by Quenstedt with unequal constrictions and without dorsal ridges is our species; its position in Wurtemberg is in the black shales with *Trigonia navis* and *Ammonites opalinus*, higher than the Frocester Hill Sands.

Ammonites Boulbienis, Young and Bird; this is perhaps only a variety of *A. Lythensis*, Y. and B., the general figure is alike in both cases, and also the ornamentation of the surface; the distinction consists in a flattening or

slight concavity upon each side of the keel in *A. Boulbiensis*, and also a greater contraction of the umbilical aperture with a slight elevation around the inner border. In Yorkshire it occurs in the Alum shale of the Upper Lias; at Nailsworth, and at Stinchcombe it has been obtained in the same position, also in the Lower Sands at Nailsworth and the Upper Sands at Frocester Hill.

Ammonites Jurensis, Zieten, *A. gubernator*, Simpson. Large fragments are not uncommon at Frocester Hill, some few small specimens have been found with the test preserved; fragments have also occurred in the lower zone of the Sands at Nailsworth and in the Upper Lias at Whitby, young specimens have the volutions more exposed and the general figure less inflated than the adult forms.

Ammonites radians, Reinecke, *A. striatulus*, Ziet., non Sow., *A. lineatus*, Ziet. A species which possesses great variability even in specimens procured from the same locality and bed, a dozen or more examples would be required to illustrate fully these variations of form and ornamentation, neither is it easy in some cases to define the limits of the species, this is more especially the case in certain radians-like Ammonites of the Upper and Middle Lias. Quenstedt has figured a variety with the volutions much exposed and inflated and with delicate closely arranged radii; another with more enveloped volutions and a compressed form with the name of *radians compressus*, both these varieties are extremely inconstant, however much they may differ in their form and in the prominence and relative proximity of the radii, it seems impracticable to separate the species into well-defined varieties. Hauer, in his work on the Cephalopoda of the Lias of the North-Eastern Alps, gives as synonyms of this species all those of *striatulus* Sow.; he also figures for *radians* an Upper Lias form which assuredly is not *radians* and ill accords with his description. *A. radians* in all its varieties may be procured at Frocester Hill, and at other localities wherever the upper zone of the Sands is fossiliferous, in the lower zone at Nailsworth, and in the Upper Lias it is comparatively rare.

Ammonites insignis, Schübler, occurs under two forms which are so very dissimilar that some doubt may be felt of the propriety of retaining them as one species, the first of these, or type, is much inflated and enveloped, the other is much more flattened with narrow exposed volutions. The typical form also assumes two distinct aspects in its adult state, the one having a compressed the other an inflated back, the latter being the figure of the young shell of both kinds. The flattened variety, *A. fabalis*, Simpson, forms a kind of connecting link between *A. insignis* and *A. variabilis*, its tubercles and ribs are however more conspicuous than in the latter species, the keel is much more depressed and the back is rounded, in the aged condition of *A. variabilis* the back is compressed

and the keel very prominent. The typical form of *A. insignis* in both its aspects occurs rarely in the Upper Sands at Frocester Hill, the lower zone at Nailsworth has also supplied young specimens, but I have failed to ascertain that it has ever been procured in the Upper Lias.* The flattened variety (*fabalis*) has been obtained in the Upper Sands at Chalford and in the Upper Lias of Robin Hood's Bay, Quenstedt has figured it from the horizon of the Sands in Swabia.

Ammonites striatulus, Sow., syn. *A. Thouarsensis*, d'Orb., *A. Comensis* d'Orb., *A. radians depressus*, Quenstedt, *A. Thouarsensis*, Dewalque, some specimens with more closely arranged ribs approximate to *A. radians*, with which it has been arranged by some authors, but it never attains the dimensions of that species, and there appear to exist sufficient distinctions between them in the characters of the septa; it is common in the Upper Sands at Frocester Hill, and also occurs in the lowest zone of the Sands, and again in greater numbers in the highest bed of the Lias both in Yorkshire and Somersetshire, the specimens are found at the upper boundary of this bed.

Ammonites variabilis, d'Orb. *A. Beania*, Simpson. The name selected by d'Orbigny is not very appropriate as the characters of the species are very constant, the young shells are tumid, and when their diameter does not exceed an inch they are difficult to distinguish from the young of *A. insignis*; in the aged condition, when the ornamentation has disappeared, the figure becomes much more discoidal and the keel very narrow and prominent, so that it is usually broken away. This is strictly a boundary species, the uppermost bed of the Upper Lias and the lowest zone of the Sands appear to constitute its limits. Aged discoidal examples constitute the *A. obliquatus* of Simpson.

Ammonites fimbriatus, Sow. A few young examples of this well-known species have occurred in the lower zone of the Sands at Nailsworth, the test has perished but the ornaments upon the surface are more or less preserved.

Ammonites crassus, Phillips, syn. *A. Raquinianus*, d'Orb. This Upper Lias species occurs in a dwarfed form but in tolerable abundance in the lower zone of the Sands at Nailsworth and at Brimscombe in the Cotteswolds.

Ammonites Ilminsterensis, Lycett. Another Upper Lias species allied to *A. crassus* and occupying the same geological position both in the Lias and the Sands.

Ammonites complanatus, Bruguiere, *A. elegans*, Sow, *A. exaratus*, Young and Bird, *A. bicarinatus*, Münster, *A. depressus*, Buch. This beautiful species

* *A. insignis*, Schüb., has been found in the Upper Lias Clays at Ilminster. T. W.

so abundant in the Upper Lias both of England and continental Europe is not altogether absent in the lower zone of the Sands. I have a single specimen from Nailsworth. The number of synonyms is probably owing to the varied forms which it assumes in the young state, some of these have the sides much flattened and the back angulated, in others both sides and back are gracefully curved; some examples have the costæ delicate, regular, and closely arranged; others have the costæ very unequal with deep and distant sulcations between them, in this condition they are scarcely to be distinguished from the young condition of *A. elegans*, Phillips, a species which is quite distinct from the *elegans* of Sowerby. The adult forms of *A. complanatus* on the other hand are very constant both in their figure and ornamentation.

There is also another *radians*-like Ammonite from the Upper Sands at Frocester Hill remarkable for its tumid form, flattened sides and flattened back, the keel is moderately prominent, and there is a slight depression upon each side of it; the costæ are large, rounded, prominent, flexuose, and very closely arranged, their prominence continues even upon the inner margin of the volution, these several characters indicate a species distinct from all the forms of *radians* and *striatulus*; unfortunately neither of the two specimens at my disposal exhibit the septa, and, in the absence of all other information, it would be unwise to tabulate it with the other Ammonites, or to decide upon its stratigraphical limits.

On some Sections of the Lias and Sands exposed in the sewerage works recently executed at Stroud. Read at May Hill, by E. WITCHELL, F.G.S., Stroud.

THE sewerage works recently executed in and adjacent to the town of Stroud have afforded an opportunity for examining the Upper and Middle Lias, and the Sands beneath the Inferior Oolite in that locality. The excavations were altogether upwards of a mile and a half in length. The section subjoined shews the depths of the strata from their elevation above the sea level. The lowest point of the excavations was at the filtering tanks below the town, the floors of which are at an elevation of 101 feet, and the highest trench on Stroudhill was about 500 feet.

The lower portion of the section, numbers 10 to 18, though taken from an excavation of 80 feet in length only, may be considered as shewing the strata of the valley of the river Frome below Stroud. Taken in descending order, we find buff coloured clay four feet, gravel four feet, blue marl two feet, marlstone six to seven feet, and the marls of the Lower Lias. It may be here remarked, that in a recent unsuccessful attempt to find water, made in the neighbouring mill-yard at Fromehall, the Lias was bored to the depth of 460 feet before the work was abandoned.

The buff-coloured clay and gravel are recent formations; the gravel though probably brought from the larger deposit known as the Stroud gravel bed, which bounds the valley on the north side and is situated at a higher level, is nevertheless a distinct bed, inasmuch as it contains drifts of leaves forming a peaty deposit in which were found fragments of land shells and branches of trees, also bones, antlers, &c., in their natural state, whereas the larger gravel bed consists of pure gravel and contains none of these deposits.

The Lias marl overlying the rock contained a thin stratum of brown earth and nodules formed of clusters of fossil casts cemented together, also water-worn limestones, the whole forming a band about three inches thick.

The casts were chiefly those of young *Ammonites capricornus*, Schloth., *Ocullaea Münsteri*, (the latter in large quantities), *Plouromya*, *Gryphaa cymbium*, and *Pecten aquivalvis*, Sow.

Below this band at a depth of about nine inches was another of a different character, composed almost exclusively of valves of *Gryphaa cymbium*. The shells were entire when uncovered but soon broke up into fragments. It was observed that the marl lying upon this bed separated

from it very readily, and a closer inspection showed a dark green substance overspreading the bed, seemingly the remains of vegetable matter only partially decomposed. In fact, throughout this particular deposit small stems and other traces of plants, generally in upright positions, were observed, and their green and dull pink colours were still visible. The stratum below the marl consisted of marlstone from six to seven feet in thickness, various in its character, some portions being exceedingly hard and others a soft shale, with numerous lumps of limestone imbedded in the mass. In colour it resembled the beds of the Lower Lias. Fossils were abundant, they were chiefly in layers varying from half an inch to three inches in thickness. In excavating the rock the partings usually took place in these shelly layers, shewing the surface of the slabs covered with a multitude of shells and casts. In fact specimens of nearly the whole of the fossils found in the entire deposit might be seen upon the surface of one or two slabs.

The following is a list of fossils procured from this deposit and the marl bed overlying it, all of which, except where otherwise stated, were abundant.

<i>Ammonites capricornus</i> , <i>Schloth.</i>	<i>Arca</i> (specimen undetermined)
————— <i>Henleyi</i> , <i>Sow.</i> (single specimen)	<i>Avicula inaequalvis</i> , <i>Sow.</i>
<i>Belemnites paxillosus</i> , <i>Schloth.</i>	<i>Pecten</i> var. <i>aequalvis</i> (?) <i>Sow.</i>
<i>Modiola scalprum</i> , <i>Sow.</i>	<i>Pinna</i> nov. sp. like <i>cuneata</i>
<i>Gryphæa cymbium</i> , <i>Lamok.</i>	———— (specimen undetermined)
<i>Cucullæa Münsteri</i> , <i>Ziet.</i>	<i>Pleuromya unioides</i> , <i>Röm.</i>
<i>Arca elongata</i> , <i>Quenst.</i>	———— nov. sp. smooth
<i>Cypriocardia cucullata</i> , <i>Goldf.</i>	<i>Unicardium cardioides</i> , <i>Phil.</i>
———— (specimen undetermined)	<i>Rhynchonella rimosa</i> , <i>v. Bush.</i>
<i>Cardium truncatum</i> , <i>Sow.</i>	<i>Terebratula</i> (species undetermined, one specimen only)

The upper portion of the section commences at Stroudhill and extends down to the river Frome at the foot of the town, shewing an elevation of 330 feet. The strata comprise three divisions, viz., the marlstone beds of the Middle Lias, the Upper Lias marls and clays, and the Sands.

The Marlstone series (exclusive of the last-mentioned bed) with the intermediate beds of marl and sand occupied a depth of 38 feet, a shaft sunk a few yards above the canal bridge at Stroud shewed the lower bed resting on the Lias, which was there at the elevation of 144 feet, or, 35 feet higher than at the filtering tanks. The Lias attains this elevation somewhat suddenly, following in this respect the inclination of the surface.

The excavation shewed the Marlstone to consist of three beds, each from four to six feet thick, separated by beds of yellow marl and sand. The thickness of the upper marl bed was about 6 feet, and of the lower about 15

feet. The latter bed contained few fossils except *Belemnites*. The rock-beds consisted of brown or grey sandstone, shewing frequent dark-red feruginous stains on the surface. The rock appeared to have been originally of a grey colour, but the feruginous stains had changed the softer portions to a brown, while the harder parts were only stained to the depth of two or three inches.

Belemnites paxillosus, Schloth, and *Rhynchonella variabilis*, Schloth, the latter occasionally in clusters, were the prevailing fossils, a few specimens of *Avicula inaequivalvis*, *Cardinia Listeri*, and *Unicardium cardiodides*, Phil., were observed.

A section of the upper beds may be seen on the north-east side of the canal, near the railway station.

On passing through the uppermost bed the marls and clays of the Upper Lias were entered, the lower parts of which shewed feruginous stains in the lamination similar to those in the Marlstone beneath. It contained numerous water-worn sandstones generally flat and varying from one to three inches in thickness, frequently containing fragments of *Ammonites serpentinus*, Rein. This species, as well as *A. communis*, Sow., were abundant, and one specimen of a Nautilus was obtained.

There was a gravel deposit also exposed a few feet above the Marlstone. It was not extensive. It contained numerous small specimens of *A. bifrons*, Brug., badly preserved.

Passing a short distance farther up the slope on which the town stands the water-worn stones and Ammonites disappeared and the deposit assumed a darker colour, and towards its upper portion there were frequent blue stains which gave it a mottled appearance. There was a total absence of rock as well as fossil remains. The junction of the Lias clay and marls with the Sands was found to be gradual. At first there were merely traces of sand mixed with the marl, then a few feet higher up the slope the deposit partook of a sandy character, and then the marl disappeared leaving a pure fine sand varying in colour from pale to deep buff. In one instance in the transition deposits the Sands assumed a concretionary character, a few sandstones were thrown out of the trenches, but it was not ascertained if they formed part of a distinct bed.

The altitude of the upper surface of the Sands could not be ascertained in consequence of the great depth of rubbly stone overlying the deposit, they were found at an elevation of 380 feet, and in the bottom of a trench at 450 feet a small quantity of sand was exposed identical with that in the excavations lower down the hill.

A (so-called) sea beach was exposed on the slope of Stroudhill at an elevation of 378 feet. It was about 200 yards in length, and composed of angular oolitic gravel very clean and fine; a similar deposit occurs at

Horn's Valley, a mile east of Stroud, and at exactly the same elevation.

In the latter deposit *Rhynchonella oolitica*, Dav., is abundant, and a few *Rhynchonella cynocephala*, Richard, may be procured.

The following section is the one referred to, taken in descending order.

	Ft. in.	Elevation above sea level at upper junction of the beds.
UPPER DIVISION.		
1 Inferior Oolite, consisting of surface rubble having been extensively quarried	120 0	500
2 Yellow Sands	120 0	380
3 Upper Lias Marls and Clays, the lower portion containing <i>Ammonites serpentinus</i> and <i>A. communis</i> ..	78 0	260
4 Upper Marlstone bed, stones very irregular and coarse, grey at the heart, but the surfaces changed by ferruginous stains, containing <i>Belemnites</i> , <i>Pecten</i> , and <i>Rhynchonella tetrahedra</i> , Sow.	4 0	182
5 Yellow Marl, occasionally Sand compressed with fine lamination	6 0	
6 Middle Marlstone bed, similar to No. 4	4 0	
7 Yellow Marl and Sand, similar to No. 5	15 0	
8 Lower Marlstone bed, of a buff colour with occasional bluish stains	9 0	
9 Blue Marl, containing nodules formed upon a nucleus of septaria or cluster of fossils. The denudation of this bed is considerable it being at the junction of the Painswick mill streams with the Frome. It appears again beneath the river drift (No. 12), below the junction, the difference of level being 35 feet ..	..	144
LOWER DIVISION.		
10 Buff coloured Clay with light blue stains near the base	4 0	117
11 Gravel containing locally drifts of leaves and branches of trees, bones, antlers, &c.	4 0	
12 Blue Marl	9	109
13 Brown concretionary nodules containing numerous internal casts of fossils	3	
14 Blue Marl, similar to No. 12	9	
15 Gryphite bed, composed principally of <i>G. cymbium</i> ..	3	
16 Blue Marl, similar to No. 12	4	
17 Blue Marlstone, very hard in certain portions, shaly in others, containing numerous shelly layers ..	6 0	
18 Lias .. .. .	..	101

Annual Address to the Cotteswold Naturalists' Field Club, read at Tewkesbury, on the 26th February, 1861, by W. V. GUISE, F.L.S., President.

GENTLEMEN of the Cotteswold Club.—In reviewing the condition of our society during the past year, I am happy to be able to congratulate you upon the satisfactory condition of our finances and upon the increasing popularity of the club, as proved by the large addition to our list of members. I wish I had it in my power at the same time to congratulate you upon a corresponding increase in the number and value of the additions to our printed transactions. This I regret to say I cannot do. It is to be observed, however, that this is no new cause of complaint, nor is it confined in its operation to the last year or two. The increasing paucity of late years in the number and importance of the papers communicated to the club contrasts in a most disadvantageous manner with those valuable communications which marked the earlier years of our existence, and which have given to our printed transactions a value which is recognised not in this country only, but on the Continent of Europe, and wherever science, especially geological science, is cultivated. To what then are we to attribute the falling off to which I have alluded? Not, certainly, to the lack of popularity, or decay of interest, for such suppositions are negatived by the increase of our numbers, and by the usually large attendance at our Field Meetings. Somewhat of this slackness during the past season may, no doubt, be attributed to the unfavourable, and we will hope, entirely exceptionable character of the summer of 1860; but we must look further to discover the causes which have led of late years to so remarkable a falling off in the number and importance of our printed papers, and first amongst these must be numbered the increasing influence and attraction of the great scientific societies of the Metropolis, whose meetings offer a more imposing audience and a wider field of fame for the working naturalist than can be expected in a local association such as ours. But after making every allowance for the action of this great central force of attraction upon our smaller and weaker body, it cannot be doubted that there is still a wide field left for our researches, from which an earnest worker may obtain an ample harvest both of utility and reputation. The vast mass of isolated and unrecorded facts which from time to time present themselves to the eye and mind of the observer,—the question of the distribution of particular forms,—the observation of local variations of

surface, form, or organization; these, and innumerable other circumstances, minute it may be, and apparently of small value, but which by careful accumulation serve as guides to important generalizations, and contribute to the establishment of truth,—offer materials abundant and inexhaustible for the labours of the local naturalist, whose work should find fitting record and publicity in the printed transactions of a society such as ours.

With reference to the publication by the London Societies of papers of local importance contributed by members of the Cotteswold Club, it has occurred to me that it may not be impossible to obtain permission for the embodiment of such papers in the printed transactions of our own club. The high character of many of these papers is such as to make us proud to number their authors amongst our associates, and their bearing upon subjects of local interest is so direct, as greatly to enhance their value to members of our society. While lamenting that such contributions to science should have obtained publicity through channels other than our own, the idea has suggested itself to me of the practicability of making arrangements that such papers should be read likewise before us, and printed in our transactions.—Such articles for instance as those by Dr. WRIGHT and Professor BUCKMAN on the “Lias” and “Oolites” are of especial interest to Gloucestershire Geologists, to many of whom it would be a great boon to have the means of reference thus brought immediately to their hands, instead of being, as at present, confined to the pages of the Quarterly Journal of Geology, to which doubtless many of us do not subscribe.

I throw this out as a suggestion, not knowing how far the rules of the Metropolitan Societies may admit of such a diversion to the purposes of local irrigation of some portion of their abundant streams of science, but I cannot but think that a judicious liberality in such respect would diminish nought of their honour or profit, while contributing largely to the encouragement and development of societies such as ours, to which, be it remembered, they should look for a body of provincial naturalists, who will hereafter, it is to be hoped, become contributors in their turn, and prove worthy followers of the able men and skilful observers who have preceded them.

At the risk of being thought tedious I have dilated at some length upon the subject to which I have just called your attention, but in doing so I have acquitted myself of a duty which it would be wrong in me, as your president, to ignore. I have, however, the satisfaction of believing that our future annals will shew a marked improvement in the number and quality of our published papers; a strong expression of opinion in this direction having been elicited from some of our leading members at our Birdlip meeting last summer, and, I may add, that the papers to be

read this evening, by Messrs. LYSONS and JONES, may be looked upon as the first-fruits of the good resolutions then entered into.

The high reputation which the Cotteswold Club has secured among kindred societies is one which should not be lightly regarded by us, nor imperilled for lack of efforts to maintain it, and we owe it no less to our character as men of science, than to the established reputation of our society, that we should employ all our efforts for the maintenance of our position as a body of scientific naturalists, and for the fulfilment of the really useful and important mission which we have accepted as our own.

It will be my duty now to detail the proceedings of the Club during the past year.

On Thursday, 23rd February, 1860, the Annual Meeting took place at the Ram Inn, Gloucester, where the usual official business was transacted, and Captain GUISE and Mr. JOHN JONES were unanimously elected to fill the posts of President and Secretary. After breakfast the party proceeded under the guidance of the Rev. S. LYSONS to examine the ancient earthworks on the hill at Newark, which had heretofore been supposed to owe their origin to the operation of the royalist forces during the siege of Gloucester. The discovery, however, of Roman remains on the site, no less than the plan and position of the entrenchments, have led Mr. LYSONS to refer the occupation of this military position to the Romans, whose *nova arx*, though altered by time, is still thought to be recognisable under the present name of *Newark*.

After luncheon at Hempstead House, the treasures of antiquity and art in the possession of Mr. LYSONS were thrown open to the inspection of the Club, and elicited general expressions of admiration. An interesting discussion arose respecting some bones, which had been discovered in a leaden coffin in a field adjoining the site of the camp at Newark, which from the use of metal in their sepulture had been supposed to be those of a young man of rank. In the judgment, however, of those best qualified to form an opinion, the relics were held to be attributable rather to an individual of the other sex; and the son of the Roman General—for no less a rank was assigned to the deceased—became the wife, or daughter, or something dearer still of that illustrious functionary.

From Hempstead many of the party adjourned to the inspection of the Museum lately established in Gloucester, which owes its existence, and the larger portion of its valuable and instructive contents, to the talents and energy of our indefatigable Secretary, Mr. JONES.

And here I would say a few words in connection with the subject, on the establishment of local museums, as being a matter of great educational importance, and one with which our society may worthily and usefully occupy itself. There are few circumstances which have a more

powerful and direct tendency to extend the love of scientific enquiry, than ready access by the masses of the people to such sources of mental gratification and improvement as are presented in a well-ordered and well-selected collection of natural objects. How far it may be practicable for us as a body to take an active part in furthering this vast aid to the educational movement of the present day is perhaps doubtful; but it is certainly the duty of every true naturalist, and individually of every member of a scientific association, to endeavour by all means in his power to contribute to this desirable object by aiding in the establishment of local museums in every town in the county. Bristol has long enjoyed a well-earned preëminence in this respect; its museum being one of the richest and most instructive in the provinces. Cirencester and Cheltenham both possess similar institutions, though on a smaller scale, and, in respect of the latter town, not, I regret to say, supported with that munificence which might be looked for in a place of its wealth and importance. It has long been a reproach to Gloucester that the metropolitan town should lag so far behind in the race; but thanks to our colleague, Mr. Jones, that stigma is now removed, and it only now rests with the citizens of Gloucester to shew their appreciation of the valuable medium for instruction thus placed at their command by furnishing such small pecuniary support as shall suffice for the care of the objects so liberally exhibited for their inspection and improvement.

It was in the hope of exercising a useful influence in this direction that Gloucester was selected as the place of meeting for the Cotteswold Club on the occasion to which I am now referring; and with a view to act still further upon public opinion in that city, I determined to depart from our ordinary custom, and to read my address to the club in public. Accordingly after dinner at the Ram, at which about fifty gentlemen were present, we adjourned to a meeting at the Corn Exchange, where we were gratified by the presence of a large and influential audience, amongst whom, the appearance of a large number of ladies was a cause of real pride and satisfaction. The details of the proceedings of a scientific body are, however, necessarily of a somewhat dry and technical nature, and it is perhaps doubtful how far they may be suited to an unscientific audience: on the other hand it cannot be thought desirable that the president of a scientific society should lower the standard of his address to the level of a popular lecture; and I have since seen reason to hesitate respecting the advantage of renewing the experiment, then for the first time tried, of reading the annual address in public, unless special local and exceptional circumstances should concur to render it useful.

I cannot conclude the notice of this day's proceedings without referring to a *jeu d'esprit* from the pen of one of our associates, which in the garb of

verse gives such a humorous and withal strictly true account of the events of the day, that mindful of the proverb "*misere utile dulci*," and unwilling that such clever pleasantry should be lost to the club, I am sure I may be pardoned for preserving through the medium of my address this record of

"A DAY WITH THE COTTESWOLD CLUB.

"Come all ye jolly Naturalists that love to go a-field,
And try to find what rocks and stones, what woods and meadows yield;
And you shall hear the story of a scientific spree
I had on Thursday, the 23rd of the month of February.
'Twas on that very morning I was going to the Docks,
For I'm the junior partner in the firm of Box and Cox;
And 'though it is in commerce that my labour chiefly lies,
I've a mighty turn for science and for curiosities;
Well, as I was going to business who should I meet but Jones;
John Jones, you know, of Glos'ter, who knows all about the bones
Of the crocodiles and tigers, and the other curious creatures,
That lived upon the Cotteswold Hills in the time of Julius Caesar;
And all about the Egyptians and the mummy of the Pharaoh,
That the man at the Museum in our town has the care o';
And many other things besides, 'though these I think no trifles,
And also he's Lieutenant of our "Dock Company Rifles."
Says he to me, says Jones, says he, Peter, says he, I say,
(For Peter is my christian name) come out with us to-day.
Come where? says I; why out, says he, with our Society,
The Cotteswold Naturalists' Field Club, of which I am Secretary,
And Mr. Guise is President, and there's breakfast at the Ram,
Tea and coffee, eggs and kidneys, bacon, hot rolls, and ham;
And afterwards we're going at the Roman Camp to look,
Then to lunch at Mr. Lysons's (says I, that suits my book);
And at half-past four to dinner at the Ram it is arrang'd,
And afterwards a "swarry" to be held at the Corn Exchange.
Well, to cut my story short, I went off to the Ram,
Where I found that his description of the breakfast was no sham.
And after breakfast with the Club to the Roman Camp I went,
And saw where Julius Caesar had pitch'd his breakfast tent.
And then to Mr. Lysons's, where some cider and some beer
Consoled me for my labours, 'though it left my head less clear
Than was good for a Philosopher, who had to look and learn
About a *Lachrymerium*, and jugs, and a funeral urn,
And a lot of bones which in the camp in a coffin they had found.
'Though whether 'twas a man or a woman to tell they'd not be bound;
For Dr. Wright, a knowing one, he said it was a male,
As it had an *ankle-moss* on the oblique trechanter's tail.
But Dr. Bird, another nob, said he'd give into no man,
For it had not cut its wisdom teeth, and therefore was a woman.
And another learned gentleman seemed with neither to agree,
For he said, in order to decide, a pelvis we must see.
Well, what with the beer and cider my head was in a pother,
So I made bold to up and say, 'twas neither one nor t'other.
So after that I thought it best to go and get a snooze,

Or else, thinks I, I shall not be in trim for what ensues ;
 And 'though I've breakfasted and lunched as well as any sinner,
 I must prepare at half-past four to do honour to the dinner.
 Well, dinner came, and pretty nigh on fifty sat at table,
 Though what we ate and what we drank to tell I am not able ;
 But everything was of the best the landlord could devise,
 At the bottom sat the Secretary, at the top sat Mr. Guise.
 And after dinner over, the Chairman gave "The Queen,"
 And then we drank the Captain's health—the President's I mean—
 And then we had a quantity of scientific chat,
 And Dr. Bird he told us a story about a rat
 That he kept upon a shelf of his study in a glass,
 And fed on prussic acid and carbonic acid gas ;—
 And how it had a liver in the inside of its back,
 And how the black rat ate the grey, or the grey rat ate the black ;
 But which was which, or which ate which, my memory does me fail,
 But I know it was a nasty beast with rings upon its tail.
 Then Mr. Norwood he got up and told about a ditch,
 A tumulus he call'd it, in the digging out of which
 He'd found a lot of skeletons with their heads upon their knees ;
 And he thought that they'd been murdered some ancient nob to please ;
 Who didn't like all by himself to the other world to travel,
 And so had these poor fellows burk'd and put into the gravel ;
 Where Mr. Norwood found them, which was not altogether fair,
 For some one had written a paper and proved they wasn't there.
 This brought up Mr. Baker, who said he didn't know
 Nothing about anything, and that fact being so,
 He told us all about it, which he was able to do the rather,
 That the paper about the victims was written by his own father.
 Then Mr. Nash got up and said they needn't be uproarious,
 For he know'd the man as digg'd the ditch, which his name it was Honorius ;
 And that, if he remember'd right, he lived to be three hundred and ten,
 And he didn't believe the story about the murder'd men
 Though as to Mr. Norwood, he'd a scientific eye,
 And knew the why and the wherefore of what he did desory ;
 Yet he thought that Julius Cæsar, or some other bloody Saxon,
 The skulls of these poor creatures had been and put his axe on.
 And so we went on talking of burning and of slaughter,
 And drinking no end of tumblers of capital whiskey and water,
 Until it was time to think to the Corn Exchange of retreating,
 Where the ladies in opera cloaks our appearance were anxiously waiting.
 About what was done at this place I don't feel perfectly clear,
 Which couldn't have been the fault of the whiskey and water and beer ;
 But I know the President gave us a remarkably lucid address,
 Though what it was all about I wasn't quite able to guess.
 But he told us of what had been done by the Club at their various meets,
 And from all that he said, I've no doubt it was quite a succession of treats ;
 For the company kept by the Club is all of the highest and best,
Ostrea and *Rhynchonella*, *Lepidoptera*, *Sphinx*, and the rest ;
 And many other aristocrats whose names are too hard to pronounce,
 Though out of the President's mouth they slipp'd as easy as bounce.
 Then Mr. Symond's inform'd us that Adam had hatchets of flint.

And the Secretary said the Egyptians had giv'n the moderns a hint,
 For Chevalier Bunsen had found twenty thousand layers of mud
 Lying a-top of the Ark where it rested after the Flood.
 Then Mr. Baker got up and said that he shouldn't blame us
 If we waited to hear the opinion of his old friend Ignoramus;
 But we couldn't none of us wait, so thanks were voted to all,
 And we clos'd with a neat little speech from Mr. Coroner Ball."

On Wednesday, 9th May, 1860, the first field meeting of the season was held at the George Hotel, Stroud. After breakfast the members proceeded to Swift's Hill and Rodborough, at both of which stations good geological sections present themselves, and a characteristic series of fossils were obtained and tabulated.

The following observations from the pen of Dr. WRIGHT embody an accurate summary of our proceedings, and register useful facts for the service of geologists.

"At Swift's Hill we saw a good section of the Oolite Marl, which had some very fossiliferous bands containing *Lima Pontonis*, Lyc., in considerable numbers and in good preservation. We likewise found several specimens of *Thamnastræa* and *Iastræa*. *Thamnastræa DeFrancii*, Edw. and Haime, was most abundant. A specimen of *Ammonites Murchisonæ* was likewise found, which was considered important as *Ammonites* are not common in the Oolite Marl. None of the Oolite Marl *Brachiopoda* were found. The beds are considerably displaced by a fault which traverses the rock in this section. The limestone is concretionary, and the *Conchifera* occur in masses, the valves of the shells being all detached.

Rodborough Hill affords a fine exposure of the zone of *Ammonites Parkinsoni*. The beds are very fossiliferous, but the shells are seldom extracted entire. The following strata are exposed:

(A.) *Upper Trigonia Grit.* A light coloured sandy limestone, with two or more fossiliferous bands containing *Conchifera*. The shells are in the condition of crystallized carbonate of lime. The bed is about eight feet thick.

(B.) *Gryphite Grit.* A brownish concretionary siliceo-calcareous rock, with valves of *Gryphæa sublobata*, Desh., and valves of other *Conchifera*, one to two feet thick.

(C.) *Lower Trigonia Grit.* A band of brownish argillaceous limestone crowded with shells, which occur in masses piled on one another so closely that is impossible to obtain one specimen without fracturing many others. This shell-bed is one foot thick, and rests on a thick-bedded oolitic limestone, bored by *Annelida*. The bored bed is a persistent stratum in this district, and marks a period of repose between the change of conditions which prevailed between the middle and upper zones of the Inferior Oolite."

After dinner, a paper was read by Dr. BIRD on the Osteology of the Otter; and another by J. D. T. NIBLETT of considerable interest to the Gloucestershire historian, inasmuch as it went to prove that to a Gloucestershire man, by name Jonathan Hulls, of Campden, belongs the merit of having been the original inventor of the steam-boat. The patent for this invention bears date 1736, and sets forth that the said Jonathan Hulls "hath with much labour and expense invented and formed a machine for carrying ships and vessels out of or into any harbour against wind and tide or in a calm, which the petitioner apprehends may be of great service to our Royal Navy and Merchant Ships, and to boats, and to other vessels passing against the stream in navigable rivers; of which machine the petitioner hath made oath that he is the sole inventor, as by affidavit to his said petition annexed appears." A pamphlet, published by Jonathan Hulls in 1737, was exhibited, illustrated by a copperplate, in which a steam-tug, on the paddle principle, is represented towing a frigate. This drawing, and the accompanying specification, clearly entitle Jonathan Hulls to the preëminence claimed for him. Some interesting local traditions relating to Hulls and his inventions, obtained by Mr. NIBLETT on the spot, give additional value to this record of the earliest attempt to propel vessels through the water by the agency of steam. As has been too frequently the fate of inventors, poor Hulls was ruined by his experiments, and laughed at as a dreamer. How little indeed could the wisest in those days have foreseen that under that rude copperplate lay hid a complete revolution in naval architecture, and all the wonders of science, whose latest triumphs have culminated in *The Warrior* and *La Gloire*.

Thursday, 7th June. The club assembled at the Longhope Station, on the line of the Gloucester and Hereford Railway. Amongst those present were the Rev. W. S. SYMONDS, President of the Malvern Field Club; Mr. LINWOOD, Vice-president of the Woolhope Club; and Mr. LIEHTBODY, of Ludlow, the indefatigable and successful investigator of the Silurian deposits in his own neighbourhood.

The state of the weather was very unfavourable, but to the credit of the club it should be recorded that this did not prevent some ten or a dozen of the members from facing the hill-side, and their perseverance was rewarded by a change in the weather, which presently cleared up, and there was no further rain-fall during the remainder of the day.

Ascending the hill immediately in front of the Longhope Station, the Upper Ludlow, Aymestry Limestone, and Lower Ludlow beds are successively passed over. On the top, and on the reverse slope of the hill, quarries in the Wenlock Limestone and Shale afford a plentiful series of characteristic fossils. Crossing the high road, the party proceeded to

the summit of May Hill, passing by the way from the Wenlock Shale to the second Limestone, known as the Woolhope Limestone, which rests in its turn against the Llandovery Sandstone, of which the central dome of the hill is constituted.

From these last-mentioned beds the following characteristic fossils were collected :

<i>Atrypa hemispharica,</i>	<i>Pentamerus lyratus,</i>
<i>Orthis calligramma,</i>	<i>Rhynchonella decomplicata,</i>
<i>Pentamerus lens,</i>	<i>Petraia subduplicata.</i>

The cold wind did not permit the party to linger long on the summit of May Hill, where search was in vain made in their usual haunts for the peculiar coleoptera which are known to frequent that locality.

Dinner was prepared at the Red Lion, at Huntley, where a party of sixteen or seventeen assembled. After dinner the Secretary addressed a few observations to the club on the subject of the beds of gravel known to geologists as "raised beaches," so frequent on the flanks of the Cotteswolds.

EDMUND PROBYN, Esq., of Huntley, exhibited a stuffed specimen of the common Marten-cat (*Martes foina*, Gmel.), which had been trapped only a few days previously, after committing sad havoc among his poultry. It had taken up its quarters in a barn, a somewhat unusual place of abode for an animal whose habitual resort is to woods and places remote from the dwellings of man. Professor Bell, in his work on British Quadrupeds, notices this exceptional trait in its character, which seems to constitute one of the more marked points of difference between it and its closely allied congener the Pine Marten (*Martes abietum*).

A paper was read by Mr. WITCHKELL upon a section of the Lower and Middle Lias near Stroud, exposed in the course of excavations, which have of late been carried on in the formation of sewage tanks. This paper, which was illustrated by a section, was of value as affording careful measurements of beds rarely so completely exposed, and accurate observations by which to test their relative value to one another, and their bearings upon similar deposits elsewhere.

On Wednesday, 25th July, the club, associated with the Archæological Institute of Great Britain, visited Chepstow, and other places in its neighbourhood. The proceedings of the day had reference entirely to matters of antiquarian interest, of which the Cotteswold Club has always taken cognizance; and the present was regarded as a favourable occasion for shewing the sympathy of the club with this important subject of enquiry, as well as with the learned and distinguished body of antiquaries, of whose congress at Gloucester this meeting was the concluding event. A large party, enlivened by the

presence of many ladies, took part in the proceedings of the day, which were directed mainly to the examination of the ruins of Chepstow Castle and Tintern Abbey, and of some singular and perplexing walls at Coed Ithel, in the village of Llandogo, about a mile and a half beyond Tintern. These latter, to which attention was first drawn by a member of the Cotteswold Club, Dr. WARSON, seem hitherto to have escaped the notice of local antiquaries, though their position on the borders of a high road would seem to invite the observation of every passer-by.

Walls of considerable extent, and in parts of cyclopean character, were found by Dr. WARSON to be associated with a smelting furnace, the remains of which, in a very tolerable state of preservation, had been concealed beneath an overgrowth of trees and underwood. Upon these latter being cleared away, the remains of the furnace with its platform were exposed, and it became evident that the walls were in some way connected with this latter, either for purposes of protection, or for some other object not easily to be accounted for. The difficulty was increased by the fact that the enceinte was not continuous; and that walls of great strength and solidity were found to be connected with others loosely compacted, and of comparatively unsubstantial construction. One transverse wall in particular attracted great attention from the massive character of the blocks with which it was formed, and the evident care and labour bestowed upon its construction. Many and various were the opinions elicited respecting the origin and object of these works, to which some attributed a Roman, some a mediæval origin; the majority, however, appeared to lean to the latter opinion, while some even assigned to them a comparatively late date; which latter view seems to derive strength and confirmation from reasons afterwards adduced by Dr. BIRD and Dr. PURCHAS at our Birdlip Meeting.

The party, about 50 in number, dined together at the George Hotel, Chepstow, when the friendly feelings of both societies found expression in words of mutual esteem, which cannot fail to have left a pleasing impression on the minds of the members present, both of the Archæological Institute and of the Cotteswold Naturalists' Field Club.

Wednesday, 1st August. The club met at Osheltenham, and dined at the Black Horse, Birdlip; the original fixture for Chepstow and Aust having been changed in consequence of the late visit of the society to that neighbourhood in company with the members of the Archæological Institute.

The field-work of the day commenced with a scramble up the oolitic escarpment of Leckhampton Hill. Arrived on the summit, the party proceeded in the direction of the Seven Springs. By the way, attention was directed to the nearly obliterated traces of a circular enclosure, which

is believed to represent the foundation of what was once an abode of the earliest inhabitants of the country, unburnt pottery of the rudest description having been found in excavating a ditch which traverses the site, and a tumulus in the immediate vicinity having been found to contain bodies buried in a very remarkable manner, with the heads resting upon the knees, a very early and unusual mode of interment.

Near this spot, a botanist of the party found a plant of the rare Frog Orchis, *Habenaria viridis*.

From the Seven Springs the party directed their steps towards the Black Horse, at Birdlip, where about eighteen sat down to dinner.

After dinner Dr. BIRD read some notes on the iron-workings of the Romans in the Forest of Dean, followed by observations upon the strange walls at Coed Ithel, near Tintern, which proved so perplexing to the Antiquaries on the occasion of the visit of the Institute to that locality. These he pronounced to be of comparatively recent date, and was supported in this view by Mr. PURCHAS, who gave instances of other walls in the Forest of Dean of like construction, the date of which is known.

The exhibition of an example of *Clypeus Plotii*, from the Great Oolite near Cirencester, gave occasion for some interesting remarks by Dr. WRIGHT upon the Echinoderms, with reference to their distribution and limits, and their value in determining the boundaries of strata, in which respect he considered them inferior in value to the Cephalopoda. He stated that he had traced *Clypeus Plotii* from the Lower Trigonia Grits to the Cornbrash; and pointed out the difference between this form and its nearly ally *C. Mülleri*.

The last meeting of the club for the season took place on Thursday, 6th September, at Cheltenham, where breakfast and dinner were provided at the Queen's Hotel.

After breakfast the members proceeded to Leckhampton Hill, at the base of which Mr. NORWOOD pointed out the position of the Upper Lias beds, a section whereof had lately been obtained by well-sinking on the site of a newly-erected house. An opportunity so favourable is rarely afforded for the examination of these beds, which are generally in the immediate neighbourhood of Cheltenham covered up by oolitic detritus. Portions of *Ammonites bifrons* and *fibulatus*, characteristic of the zone in question, were found at this spot by Mr. NORWOOD.

The Oolitic Section at Leckhampton was next traversed by the party throughout its whole extent, and was thoroughly explained by Dr. WRIGHT.

The Pisolite beds were first minutely examined, and the concentric structure of the grains well ascertained. The learned Doctor gave it as his opinion that these beds were accumulated in tranquil seas of

no great depth; in proof whereof he adduced the facts—that the beds contain for the most part species of a littoral character—that the pisolitic grains are frequently found to be coated by a minute Bryozoon, *Berenios diluviana*—and that the tests of the urchins, which are not unfrequent, are usually found in good preservation, sometimes even with the spines attached.

Overlying the Pisolite is the Roestone, which passes upwards into the Freestone, of which indeed it forms the base. It is the opinion of Dr. WRIGHT that a great change took place in the conditions of the sea-bottom after the deposition of the Pisolite; the upper beds of the latter being full of life, whereas in the succeeding zone, the forms are few in number and dwarfed in size, shewing that they had a struggle for existence, and lived under difficulties. Another remarkable peculiarity mentioned by the Doctor, in connexion with the Roestone beds, is the circumstance that they contain special forms, of which one-half or two-thirds reappear in the Great Oolite.

To the Freestones succeeds the Oolite Marl, a purely local deposit, distinguished by *Terebratula fimbria*, of which this zone is the metropolis. As far as hitherto ascertained, this Brachiopod is as local as the deposit which it characterises; being restricted to England, beyond the limits whereof it has not hitherto been detected. *T. fimbria* is not, however, confined to the true Oolite Marl, so called, but passes upwards into the overlying bastard freestones, in which, at Shurdington Hill, it is visible in great abundance.

Passing westwards along the escarpment, the position of the great Oyster-bed, containing *Gryphæa sublobata*, was well seen, with the Upper and Lower Trigonia Grits, between which the *Gryphæa* bed is interposed. At this point the attention of the party was directed to a good example of the accumulated detritus, by some called raised beaches, by others attributed to glacial action. Dr. WRIGHT and Mr. NORWOOD were, however, of opinion that these and similar accumulations, plentifully scattered along the flanks and base of the Inferior Oolite, are in fact the *talus* of the escarpment, and owe their origin to the waste of the cliffs under atmospheric influences.

From the summit of the escarpment the party proceeded in the direction of Shurdington Hill, for the examination of the great geological fault, which, commencing near the village of that name, has been traced in a direction east and west for a distance of ten miles. A detailed description of this fault may be expected from the pen of Mr. NORWOOD, who has made a careful study of its peculiarities. The effects of it are well seen at the head of the valley which separates the flank of Leekhampton Hill from that of Shurdington opposite. Here, at a point

where a house has been newly-erected, a well-sinking has revealed the fact that the freestones on the one side of the line of fault have been thrown down to a level with the Lias Sands on the other side, shewing a down-throw of about 90 feet. This is still more strikingly displayed on the adjoining Heartly Hill, where the Fuller's Earth and Stonemfield Slate may be seen on a level with the middle beds of the Inferior Oolite.

Standing on the point of Shurdington Hill, Mr. NORWOOD described the relations of the beds to one another, and pointed out the physical peculiarities of the region, especially with regard to the numerous lines of fault which, having a direction east and west, traverse this district at short intervals, and have doubtless exercised an important influence in the excavation of those profound lateral and transverse valleys, which have for the most part been sapped along these ancient lines of fissure.

From Shurdington the party returned to Cheltenham, where about twenty-two sat down to dinner, after which, a discussion arose respecting the much-canvassed theory of the transmutation of species through the agency of Natural Selection and "the struggle for existence," as propounded by DARWIN. In which discussion Dr. WRIGHT, the Rev. T. W. NORWOOD, Rev. W. S. SYMONDS, Mr. NASH, Dr. BIRD, and others took part. It would be out of place here to enter at length upon an examination of the subject thus brought under discussion, which is in its nature too important, and in its relations, both physical and metaphysical, too intricate and manifold to be dismissed in a few words.

The opinions elicited, though diverse, had certain points of agreement, which may be briefly stated as follows.

1. That although Naturalists may be unable accurately to define the limits between species and varieties; yet that species have an absolute existence in nature.

2. That the law of variation on the theory of descent through modification is not borne out by experiment, but rather the reverse; the tendency to return to certain original types being constantly manifested.

3. That the admitted pliability of certain races under the hand of man, however extraordinary, is no proof of a similar plasticity in nature: certain races, as dogs, appearing to be eminently liable to variation; while others, as cats, though exposed to similar influences for an equal length of time, remain unchanged.

4. That though the "imperfection of the geological record" be admitted; and every allowance made for the "poorness of our palæontological collections;" and for the limited portion of the globe which has hitherto been carefully explored; enough still is ascertained to shew an utter absence of these transitional and connecting links, which according to the

"Natural Selection" theory, must certainly have existed at all former periods of the earth's history; and, that pending the discovery of such links, it is a mere begging of the question to assume that they have existed, and, (in the words of Darwin) that "the chief laws of Palaeontology plainly proclaim that species have been produced by ordinary generations: old forms having been supplanted by new and improved forms of life, produced by the laws of variation still acting round us, and preserved by Natural Selection."

Lastly. All seemed to agree in conceding that although the Darwinian theory does not reconcile all discrepancies, and though, as many think, it is founded upon too slender a basis for the vast superstructure erected thereupon; that, nevertheless, the influences treated of by its author must, for the future, be allowed to have great weight in any computation of those secondary laws, which all believe to have been impressed upon matter in the beginning, and by the action whereof many important changes in organic life have been brought about.

With this final meeting of the Cotteswold Club my task as your annalist is brought to a termination. I feel, however, that I cannot more usefully conclude this summary of our proceedings, than by transcribing a report I have received from our valued colleague, Professor BUCKMAN, having reference to the effect upon vegetation produced by the extraordinary climatic phenomena which prevailed throughout the year which has just passed; and embodying the results of his interesting experiments upon "food-roots," and upon the "ennobling" of wild vegetables, in which latter attempt he has obtained such marked and surprising success.

Professor BUCKMAN writes as follows.—"In 1859 I planted a plot of *Sorghum saccharatum*, the newly-introduced Chinese sugar-cane, and there was about a quarter of an acre sown on the farm. This grew upwards of SEVEN FEET high, and yielded a weight of green food over fifty tons to an acre. On planting the same kind of seed, in the same manner, in 1860, it scarcely attained to six inches. The failure in 1860 being even more complete than the success in 1859.

"Indian corn ripened with me in 1859: in 1860 it never even flowered. In 1859 I got some seeds of the *Brassica oleracea*, Wild Cabbage, from the rocks of Llandudno, North Wales; this is now in cultivation in my experimental plots, and already I see hopes of getting all kinds of cabbage, and many greens, and the like, from this original source. But the most interesting point brought out by these experiments this season has been, that while ordinary cabbage-stuffs have been cruelly killed by the severe frosts, my wild cabbage plants are perfectly sound and healthy. My parsnips, ennobled from the wild root, are now established and in the seed market. One of my most interesting experiments

has been on the growth of Mangel Wurtzel. This crop has been recommended by some 'because it will grow leaves which may be used as green food for cattle, and also its roots, as a store-food.' But I concluded from experiments carried on years ago, that as long as a mangel leaf was fit for cattle food its functions were required to aid in the development of the root.—In other words, that you could not destroy the leaf (the lungs of the plant) without detriment to the crop. However, after detailing some carefully-conducted experiments performed in 1859, which resulted in shewing a loss of **QUITE HALF THE WEIGHT OF ROOT** from three strippings of the leaves, I was opposed by an Irishman, who said that he took at the rate of as much as five tons of leaves from an acre of mangels, and that his crop of roots was increased thereby. It also came out in the course of conversation on the matter that Colonel **KINGSORE** was in the habit of feeding from the green leaves of mangels, and, as was stated, got more root in consequence. Now, I got nine sorts this year for experiment; these were planted in separate plots, and thinned to twenty-four roots in each plot. Of these, twelve roots in each plot were denuded of their outer leaves twice, on the following dates, September 4th, and September 24th. On November 12th, 1860, both sets in each plot were topped and tailed and weighed with the following results.

"TABLE OF RESULTS.

Name.	Twelve Entire Roots.		Twelve Stripped Roots.	
	lbs.	ozs.	lbs.	ozs.
1 Elvethan Mangel	8	10	5	4
2 Yellow Globe.....	9	0	5	2
3 Red Globe	8	2	6	12
4 New Olive-shaped Red Globe.....	11	13	7	6
5 New Olive-shaped Yellow Globe	16	13	12	3
6 Sutton's New Orange Globe	9	5	3	12
7 Improved Long Yellow	19	0	9	11
8 New Long White	15	0	7	8
9 Silver Beet.....	16	15	5	9
Total.....	114	10	63	3
Average.....	12	11	7	0

"Now these results upon so many sorts would seem conclusive, and the question then is, how the discrepancies in my experiments when compared with others can be reconciled. I can only account for it by supposing that others experimented upon large patches, and calculated from weighing only a portion; in which case, to put aside any thought of a bias, either one way or the other, it will be conceived that it must be difficult to make choice of a bit that could be relied upon as a positive

average, and therefore it is that I claim for my experiments a greater probability of being free from errors of this kind, as they are upon a smaller scale, and I could weigh the *whole results*. And, as they are such as a knowledge of Vegetable Physiology would lead us to expect, I have no doubt of their truth.

"I would now mention, that when the plants of the nine plots were being thinned, twenty-four plants of each kind were transplanted, thus making nine transplanted plots. Of these, half were *stripped*, as in the previous experiments, the other half, as in them, being left intact. As these results are of great interest I give them.

"TABLE OF RESULTS—TRANSPLANTED MANGEL WURTZEL."

Name.	Twelve Entire Roots.		Twelve Stripped Roots.	
	lbs.	ozs.	lbs.	ozs.
1 Elvethan.....	14	10	5	10
2 Yellow Globe.....	13	0	6	14
3 Red Globe	15	4	7	3
4 New Olive Red	12	4	5	6
5 New Olive Yellow.....	11	14	7	10
6 Sutton's New Orange	10	2	5	9
7 Improved Long Yellow	15	10	11	1
8 New Long White	12	11	7	6
9 Silver Beet.....	15	13	6	11
Total.....	121	4	63	6
Average	13	5	7	0

"These experiments, I hope, will not be without value, in both a practical and a theoretical point of view: and if laid before the Cotteswold Club, they may lead to some interesting observations."

On the Drifts of the Severn, Avon, Wye, and Usk. By the Rev. W. S. SYMONDS, F. G. S., Rector of Pendock, Worcestershire.

THE hardened Plutonic crust of the earth, the crystallized skeleton of the globe we inhabit, consists of rocks which the geologist believes were once molten and in a fluid state. In the carefully-conducted experiments made during the sinking of the Dukinfield Deep Mine, one of the deepest pits in this country, it was found that a mean increase of temperature of about 1° of Fahrenheit occurred in seventy-one feet. The influence of pressure on the fusing point, and the relative conductivity of the rocks which form the crust of the globe have, however, to be taken into account, and the important experiments lately instituted by Mr. HOPKINS, Dr. FAIRBAIRN, and Dr. JOULE, have led the mathematician to believe that the solid crust is at least 200 or 300 miles in thickness.

It is upon this cooled, hardened, crystallized crust, whatever mineralogical form it assumes, that the oldest sedimentary rocks are superimposed. All sedimentary strata are deposited from water, and the fact of their existing proves the wear of water, and the action of the atmosphere, on preëxisting materials, in elaborating the sediment which settled in the hollows of ancient seas.

Deepest, and oldest known, is the stratified Gneiss of Sir RODERICK MURCHISON, which, in the Hebrides, the island of Lewis, and the north-west coast of the Highlands, is seen to underlie the equivalent deposits of the Cambrian rocks of North Wales, the Longmynd, and Ireland. These lower Cambrian deposits are also the precise equivalents of the Laurentian system of Canada, as described by Sir W. LOWE. Hitherto no fossils have been found in them.

The succeeding series of rocks indicate by their depth and thickness the lapse of a long space of time between the deposition of their earliest strata and their last.

The upper Cambrians furnish us with remains of sea weeds, worm burrows, corallines, fossil ripple marks of ancient waves, and the impressions of rain drops that pattered on the sandy shore.

The Upper Cambrian deposits pass, by insensible gradations, into a series of rocks many thousand feet in thickness. These are the Lower Silurians of MURCHISON, and afford many marine fossils, some as highly organized as Cephalopods; but no vertebrate animal, such as fish, reptile, bird, or mammal, has yet been detected in their matrix.

There is no break between the Upper Silurians and the Lower Silurians; and none between the Upper Silurians and the old Red Sandstone; or between the old Red and the Carboniferous deposits. All these rocks pass conformably, in certain localities, one into another. In the Lower Ludlow rock of the Upper Silurians, however, and two thousand feet below the uppermost beds of the Silurian formation, a fish, the *Pteraspis Ludensis*, has been detected; while in the uppermost deposits the seed vessels of land plants have been found. The remains of fish and terrestrial plants are abundant in the old Red rocks; and the Carboniferous strata yield the remains of the most profuse terrestrial vegetation the world ever beheld, the remains of insects and of land shells and reptiles. In the Permian rocks, traces of birds are known by their footprints; and in strata of the age of the Trias, the base of that great series of secondary deposits which includes the Lias, the Oolite, and Chalk, we find the first discovered relics of a mammal, the *Microlestes* of Pleininger. The Tertiary formations with their long periods of Eocene, Miocene, and Pliocene, exhibit marvellous and numerous forms of quadrupeds, which have long since passed away. The enormous lapse of ages that must have passed between the close of the Pliocene period, and the recent or present period, may be gathered from the fact that the immensely protracted Glacial period intervened, with all its arctic and subarctic phenomena, and which must have extended over many thousands of years. It is with the maximum development of this epoch that our first drift deposits must be correlated. We have evidence that during the Pliocene period the warmth of northern latitudes slowly decreased, until during the maximum of the Glacial period the cold became so intense that we must look to Antarctic rather than Arctic phenomena to explain the history presented to the student of Glacial phenomena. It is well to refresh our memories with a perusal of Antarctic voyages; and to remember the history of the Antarctic regions at the present time, when Ice holds fast, in his gelid grasp, the land of Victoria and Erebus, as in one vast glacier. We know, from Mr. DARWIN, that immense glaciers are found in the latitude of Paris, and that icebergs, and ice floes, drift with their burdens hundreds of miles further towards the equator, than they do when drifting from the north. From all we gather, the history of the Arctic and subarctic latitudes, during the Glacial epoch, was that of the present Antarctic character and influences. The Antarctic regions are chiefly covered by the ocean, and the great waters prevail towards the tropics; and so, during the Glacial epoch, there was no doubt a far larger area of sea in the north temperate regions by some thousands of square miles than at present; and the sea as far south as Austria in Europe, and Pennsylvania in America, must have been traversed by ice floes, packs, and bergs. "I venture to

affirm," says Mr. ROBERT CHAMBERS, "that if a Glacial sea was the main condition of the surface of the present northern continents during this first Pleistocene epoch, the ice was exhibited in a volume prodigiously beyond all present examples. The ice of this epoch was in masses of sufficient extent and depth, to embrace, holdfast, and work upon large irregular surfaces, whole provinces of the present world, which it moulded down into certain outlines, partly determined by the character of the subjacent rocks. In what is now Scotland, mountains up to at least three thousand feet, and connected valleys of many miles in width, were undoubtedly swept, worn, and moulded by one connected movement of this mighty agent."*

It is impossible that what many geologists consider as Glacial action can account for the ancient Ice phenomena exhibited in northern regions, or even in Scotland and Wales. The land must have been ice locked for ages, as ice bound as in Victoria Land now. The sea must have been frozen to its very bottom in the shallower straits, the ice gradually moving to the south, grinding down the sea bed into grooves, valleys, and ridges, and carrying blocks of rock far from their parent bed. No amount of ice floes could, I feel satisfied, effect the work we have to account for. Every geologist knows that great changes of the level of land and sea have occurred within the period of existing marine shells; but it was not until I engaged in investigating the history of the travelled boulders of this part of England and of Wales, that I realized the great physical alterations which have taken place in these districts since the commencement of the Glacial period. It is impossible to enter into particulars in a brief paper of this kind, but I may state that I am convinced that the greater part of this part of England and of South Wales was underneath the sea during some portion of the Glacial epoch.

ROCK DRIFT. I have seen numberless instances of what I would denominate Rock Drift, consisting of great boulder stones carried from a distance, on hills now elevated several hundreds of feet above the level of the sea.

The perched blocks of quartzite upon the chalk marl ridges above Swindon, and the celebrated stones of Stonehenge, are, I believe, blocks that belonged to a formation newer than the chalk, which have been perched in their present situation by ice floes of the Glacial period. The Druids may have *arranged* Stonehenge, but assuredly ice was the power that transported the rocks. Along the flanks of the hills of Dean Forest, and on those of the South Wales coal field, I have seen numerous transported blocks resting upon formations to which they do not belong. Bradnor hill, above Kington, consists of Upper Silurian deposits

* Ice and Water. Edinburgh Papers, by R. Chambers.

but great masses of greenstone and Llandovery conglomerate rest upon its summit, as my friend Captain Guise can testify.

The celebrated Arthur's stone on Merbridge Hill, near Winforton, on the Wye, is a transported block which could only have been carried by an ice floe. I could give many instances and examples, but enough has been said to call attention to the fact that these transported boulders are to be found throughout Herefordshire and Wales, and that they must have been dropped where they now rest when the summits of hills as high as Merbridge and Bradnor were beneath the ice-traversed sea. The more I enter into the history of the boulder phenomena, the more I feel assured that the part of England we now inhabit was principally beneath the sea at an early period of the Glacial epoch, and it was during this epoch that I believe the scooping out of the valleys was effected by the agency of ice and water, during a protracted epoch, and which denuded, or rather degraded, the enormous thickness of strata which have been scooped out between the Malverns and the Cotteswolds.

HIGH LEVEL DRIFTS (Marine). These drifts occupy heights ranging from 70 to 250 feet above the Severn. The land was gradually rising, and the elevated surfaces of the sea bottom, over which in the Rock Drift epoch waves covered with ice floes rolled, appeared as dry land. For age after age the land arose, and the former bed of a sea became the haunts of the mammoth, the long-haired rhinoceros, and the tail-less hare. Boreal shells lived in the seas. England must have then been joined to the continent of Europe, and probably Ireland was continuous with the Isle of Man. In our own district I cannot doubt that the *high level* drifts were deposited during the period of the Malvern straits of MURCHISON, when the Malverns and Cotteswolds were elevated above the sea level, but when hills 300 and 400 feet in height were submerged in the waves. I suspect that we shall be obliged to divide the high level drifts into two distinct and separate deposits, as representing different sea bed surfaces, and appertaining to different epochs of elevation of that sea bed.

I am not quite satisfied with the correlation of drift deposits on the summits of Corsewood Hill, Wainlode Hill, Gadbury Camp, and other hills of considerable elevation, with drifts which occupy lower surfaces, as at Tunnel Hill, and Ryall Hill, near Upton-on-Severn; Twining gravel pits, at Shathonger common, near Tewkesbury; and Elmore, near Gloucester. We have yet much to investigate before we can hope to obtain a clear insight into the history of our Worcestershire and Gloucestershire drifts, and the reason which induced me to bring the subject before the members of the Cotteswold Field Club was in the hope that I might receive the valuable coöperation of the members of this society. With regard to the fossils of the high level drifts, we have of late obtained

some satisfactory results. Along the flanks of the Malverns they have yielded the remains of *Elephas antiquus* and *Rhinoceros tichorinus*, animals that lived through the Glacial epoch.

The Malvern Museum possesses some of these interesting relics, which were found in digging for the foundation of the Railway Hotel at Great Malvern, lying in a stiff clay, and covered by a mass of subangular atmospheric debris.

Some fine bones of these animals, with the forearm of *Bos primigenius*, were presented to me by Mr. STEPHEN BALLARD, from three localities on the flanks of the Malverns; and I have lately obtained a nearly perfect molar of the Mammoth from the Gravels of Twining, at Shuthonger common, near Tewkesbury. A fine molar of *Elephas antiquus* has also been found lately by HENRY BROOKS, the Ledbury geologist, among the gravel overlying the masses of angular blocks which are heaped against the side of the hill, known as the Clinchers Mill Wood, near Ledbury. The position and size of these angular blocks are remarkable, and Mr. PRESTWICH and Mr. ROBERT CHAMBERS, both well-known authorities on ice phenomena, agree with me in attributing their deposition to the effect of coast ice drifting down the Clinchers Mill Bay during the epoch of the Malvern Straits.

No shells have hitherto been detected in these deposits of gravel, clays, and sand, although in the low level drifts we shall observe that they are not uncommon. My readers will doubtless remark that the Glacial climate continued during the deposition of the high level drifts, as evidenced by the Clinchers Mill blocks. This was probably the period of the Glaciers of Snowdon and the mountains of Scotland and Ireland, a period long posterior to that of the Rock Drift, when I think it probable that even our Malverns received their rounded form by the ice action of a frozen sea, whereas, during the deposition of the high level drifts their hoary heads were well above the sea which washed over some three hundred feet of their eastern base.

The long-haired elephant and the long-haired rhinoceros roamed over the lands of the Cotteswolds, the Malverns, and Siluria; and left their remains to testify of their existence, while, doubtless, the vegetation was of Arctic type, and included such plants as the herbaceous willow, the Alpine gentian (*Gentiana nivalis*), and the snow Saxifrages and Veronicas.

THE LOW LEVEL DRIFTS.—(Estuarine on the Severn, and Freshwater on the Avon, and probably Wye and Usk.) I formerly was inclined to correlate these drifts with those of a much later period, which will be described hereafter as belonging to the Lake period. Within the last few months my distinguished friend, Mr. PRESTWICH, has convinced me that I was wrong, and that the low level drifts are altogether antecedent to,

and independant of the detritus which fills up the beds of the ancient freshwater lakes. They are, in fact, the relics of broader rivers, of which the channels must have been thirty or forty feet above the present river channels; and eighty or ninety feet, allowing forty feet for the depth of the lakes, above the old lake bottoms. The low level drifts have been scooped out by the action of the ancient Severn, Wye, Avon, and Usk, and though once continuous must be now studied above the margins of the silted up lakes, now the Holms or large flat alluvial meadows along the river banks.

These beds of drift are well developed on the Avon, at Cropthorne and Bricklehampton, at Defford and Eckington, and again near Tewkesbury. They rest on a tabular platform of some thirty feet above the river, and above them a high level drift occupies another platform, as at Bredon, which stands at a height of seventy or eighty feet above the Avon. On the Severn they may be studied in many localities, of which I may mention the Workhouse Gravel Pits at Upton-on-Severn, and the Oxeye-gate, about a mile from Tewkesbury, on the high road to Ledbury. Upton-on-Severn is a good locality for seeing the relative position of high level and low level drifts; the former occupying the high ground of Tunnel Hill, and the latter ranging along the margin of the silted up lake of Upton race course.

I find these drifts well developed on the banks of the Wye, in many localities, as at Broomy Hill, near Hereford, and the opposite bank of the river. They may be compared with the high level drift of that district, near the Kites-nest, on the high road to Hay and Brecon, about four miles west of Hereford.

At Brecon, I found a most interesting old river, or lake margin of well-stratified gravel and sand, on the slope of a hill, at the height of sixty or seventy feet above the river Usk. The locality is Heolhir, or the Long Lane, a little way south-east of Llanfaes.

It is in these drifts that the explorer finds such numerous relics of the extinct mammalia. Remains of the Elephant, Hippopotamus, Rhinoceros, Hycena, with several species of Deer, and three of Bos, were collected by the late Mr. HUGH STRICKLAND in considerable abundance from these drifts of the Avon; and by Mr. JAMES ALLIES on the Severn. From investigations, which I have lately made, I entertain a decided opinion that the bone caves of England appertain to the same epoch as the low level drifts. I cannot, however, enter here into the details necessary for the proof of this correlation. I must, however, give my testimony against the supposition that the cave bones were washed into their present site, or that diluvial action had anything to do with their deposition. I believe that the caves are neither more nor less than the relics of fissures in the rocks, through which streams flowed, as streams flow now in Ireland in the mountain limestone. The caves were themselves the haunts of the large cave

carnivora, the cave lion, cave tiger, hyæna, and cave bear. These animals not only destroyed the ruminants, the remains of which, with those of sucking mammoths, are found in such abundance in the caves, but they dragged them to haunts, where they gave birth to their own young, and where the remains of the baby hyæna are frequently found mingled with those of its aged parent, and with the relics of hundreds of their prey.

Wherever I have seen these caves I have also seen evidence of oscillation and movements of the surface of the land since the cave epoch. At Banwell cave there is proof of the former existence of an underground rivulet, the flow of which has been actually reversed. I believe that elevation of the carboniferous limestone has taken place since the cave epoch, and that this elevation was the cause of considerable change in the position of the fissures in which the cave animals had their dens. It is in the low level drifts, or their equivalents, that M. BOUCHER DE PERTHES, Sir CHARLES LYELL, Mr. PRESTWICH, and many other geologists, have found the flint implements which have lately determined the great antiquity of the human race. I have also been informed that Mr. EVANS has lately found a well-defined flint implement in high level drift near Bedford. If this case is well authenticated, it antedates the history of the human race still further in the records of time.

We find that these drifts on the Avon contain numerous freshwater shells. The most abundant species are *Cyclos amnicæ*, and *cornea*; but with these Mr. STRICKLAND found the *Unio antiquior* and the *Cyrena consobrina*, which is now extinct in Europe, though living in the Nile. The teeth of the mammoth in these drifts are much water worn, and I suspect have frequently been washed out of the *high level drifts*. There are, however, some splendid remains of this animal at Worcester, which were found in *low level drift* at Himbleton, and with which the living mammoth was no doubt contemporaneous. These drifts on the Severn have furnished many marine or estuarine shells, to the researches of Mr. ERRON, of Eyton, Mr. JAMES ALLIES, and Mr. LEES; and it appears that an estuarine condition affected the Severn vale at the same time that a freshwater condition was established on the Avon.

THE LAKE EPOCH. There was a time long antecedent to the days of the Romans when both the Severn and Avon flowed, as the river Shannon does now, through a chain of various sized lakes.

The racecourses of Worcester, Upton, Tewkesbury, and Gloucester, were formerly lakes forty and fifty feet in depth, into which rivers poured their sediment for ages, until the beds of the lakes became gradually silted up and the rivers had to cut their channel through the lacustrine silt. During the excavations made for the Tewkesbury docks the alluvium of the

Severn was excavated down to the old lacustrine silt. The alluvium of the present river is between twenty and thirty feet thick. Below this was a stiff tenacious red clay, and below this, again, a black lacustrine silt, containing freshwater shells, some ancient pottery, and a fossilized horn of a red deer. The pottery was thirty feet, and the red deer's horn was thirty-seven feet and a half from the surface. Both were found in the lacustrine silt.

I have to thank Mr. ALFRED WILLIAMS, the engineer of the Tewkesbury Docks, for these particulars. I would also observe that abundance of freshwater shells are found in the old lake beds only. They occur in thick masses imbedded in black mud with drift wood and fossil nuts. Mr. STRICKLAND has sunk through the Severn alluvium near the Haw Bridge; but neither here, nor at Tewkesbury, nor at the Brick-pits at Upton-on-Severn, could I ever obtain any well-preserved specimens of freshwater shells; yet, if we once strike the *lacustrine* mud, which is overlaid by the alluvium, freshwater shells occur in thousands. Mr. STRICKLAND possesses a mass of these shells, obtained from the very base of his brick-pits, imbedded with the teeth of a large horse. In Worcester Museum we have the remains of existing animals, but no remains of the extinct mammalia from these lake silts. The human skeleton found at Defford on laying the foundation of the railway bridge, and recorded by Mr. HUGH STRICKLAND; the ancient pottery near the base of the Tewkesbury Docks; and the skeleton in the peat moss near Mickleton Tunnel, all probably belong to the lake period.

ALLUVIAL DEPOSITS. The first point we remark is the great difference which at present obtains in the deposition of silt and alluvium by such rivers as the Severn and Avon, compared with the swift flowing streams like the Wye and Usk, which have a fall of as much as two-and-a-half feet in a mile along their general course. In some localities the Wye has shifted its course, filled up its former channel, and cut out a new bed, within the memory of man. Mr. Charles RICHARDSON, C.E., in his contribution to the Edinburgh New Phil. Journal, entitled "Chronological Remarks on the River Wye," mentions an instance of the shifting of the course of the Wye, as proved by an old map, which gives the position of the celebrated Ross Oak, now known as the Burnt Oak, and the river as it flowed a century and a half ago. A broad surface of meadow land now sweeps where the Wye then flowed, and the river now runs some seventy or eighty yards from the former bank on which that old oak stood. Indeed, many of the old inhabitants of Ross lately assured me that the channel of the river Wye, near the town, has been very much changed since their own remembrance. This, however, is not the case with the smoothly flowing Severn and sluggish Avon, to anything like the same

extent, for a Roman funeral urn, containing the ashes of the dead, has been found buried on the river banks, near the Hawbridge, between Tewkesbury and Gloucester. The urn was open at the top, and the ashes must have been washed out had the urn been drifted; besides, I am assured by Mr. STRICKLAND, of Apperley Court, who possesses this relic, that the urn was found perfectly upright, and had evidently been buried where it stood. Deerhurst church, a little higher up, is known also to have been of Anglo-Saxon date, and stood in Saxon times much in the same position with respect to the Severn as at present. I therefore believe that the river Severn flows in much the same channel, between Worcester and Gloucester, as in the days of the Romans.

The point to which I would direct attention is this: that all these rivers may alter their course, and destroy and reform their alluvia over and over again, for age after age, without in the slightest degree changing their courses, save as regards the level alluvial land. The results arrived at by Mr. RICHARDSON, from mathematical and arithmetical calculations, are, that the Wye has flowed within its boundary of the old red rocks of the Ross district for more than eleven millions of years. I do not pretend to enter into the elaborate calculations from which Mr. RICHARDSON has come to this determination, but I must say that I have been lately much impressed with the evidence of antiquity furnished by the alluvial deposits of our rivers of Worcestershire, Herefordshire, and Monmouthshire, and I do not see how we can deal with them in any way without allowing enormous periods of time.*

* See Edinburgh Phil. Journal. October, 1861.

Geology of Churchdown Hill, (Part I.) By FREDERICK SMITHE, M.A., F.G.S., *Member of the Cirencester Natural History Society, &c. Read at Dumbleton, August 14th, 1861.*

Of the principal hills standing aloof from the Cotteswold range, namely, Bredon, Stanley, Dumbleton, Oxenton, Notting, and Churchdown, the latter has been not unfrequently referred to by writers on the middle division of the Lias system; but although the name of Churchdown has thereby become familiar to the geologist, there does not exist any full and detailed description of it more succinct than that given in Murchison's Outline (Ed. 2, by Buckman and Strickland, 1847). Indeed, one may hazard the remark that this outlier has never been completely and faithfully sectionized. I have, therefore, ventured to make the attempt, and have here thrown together the observations of the last two weeks' study of the uppermost portion that constitutes the capping of the hill, and which reposes conformably upon the Marlstone of the Middle Lias; intending at a future time to investigate, *seriatim*, the remaining subjacent deposits. It may be of assistance, by way of index, or as bringing the subject in its entirety before the eye, to add an outline of the main divisions of the Upper and Middle Lias sections received by European geologists. In descending order, according to the characteristic *Ammonites* prevailing during each period, we have

1. The Upper Lias, containing the { *Jurensis* zone...above,
 Communisbeneath.
2. The Middle Lias, comprising the { *Spinatus*,
 Margaritatus,
 Davosi,
 Ibex,
 Jamesoni, } Zones.

The Upper Lias may be briefly defined as a mass of shale upon a bed of rock, and Churchdown possesses the lower beds only of this Upper Lias mass. Beneath them we have exceptionally the zones of the lower division just cited; from the *Spinatus* to the *Jamesoni* beds.

Here, though, in accordance with my plan, I shall treat only of the Upper or *Communis* beds. It would be futile to pretend that Churchdown Hill is a typical locality for this subdivision, either in the thickness of its deposits, or in the strictness of their sequence; still, though not claiming for it in these respects the appellation of typical, it will repay any

geologist to work, and falls short of few places in many interesting particulars, as I shall attempt to show in the sequel.

Mr. HULL declares that of all the formations in this district, there is none which affords fewer opportunities of examination than the Upper Lias shale. Its surface indications are useless, and further, they are too often concealed altogether by the débris, from its crumbling nature. My observation confirms this: the wind, frost, and rain, of the last winter have nearly buried the lower beds of our hill with tumbled shingly rubble. The quarries on the top of Churchdown Hill are two, which may be distinguished as the North and the South. The South Quarry being the larger and yielding the better section. The upper set of strata there disclosed constitutes the Communis zone, and, as the name Communis, now generally used for this zone, cannot, as yet, be declared thoroughly naturalized, it may not be amiss to prefix the chief synonyms, as employed by some of the leading writers on the subject.

SYNONYMS AND EQUIVALENTS.—The Communis beds are:

The Upper Lias Shale (lower part), ..	<i>Phillips</i>
The Alum Shale (lower part),	<i>Young & Bird</i>
The Upper Lias (lower part),	<i>Murchison</i>
The Communis Zone (lower part),	<i>Wright</i>
Etage Toarcien (partie inférieure)	<i>d'Orbigny</i>
Bituminöse Mergelschiefer	<i>Schlotheim</i>
Posidonia Schiefer	<i>Bronn</i>
Schiste et Marne de Grand Cour	<i>Chapuis et Dewalque</i>
Schistes de Boll	<i>Marcou</i>
Posidonomya Schiefer et Monotis Kalk	<i>Römer</i>
Lias (epsilon)	<i>Quenstedt</i>
Liasschiefer	<i>Von Buch</i>
Posidonomya hett	<i>Oppel</i>

And under part of the Upper Lias of English, French, and German geologists.

The two Churchdown quarries lie relatively to each other, nearly in the line of their dip, namely north and south, with a gentle elevation of their beds to the south, at an angle of 8° or 10°. At this small inclination, a right line of prolongation, directed to Painswick Hill (altitude 929'), would exactly coincide with the same strata, at an equal value of the angle: these very beds attaining at Painswick the thickness of 80', while at Churchdown they are about 10'. Churchdown thus presents a truncated summit, from its ancient capping being eroded to this extent, and washed into the vale, where it is strewn in well-defined bands of gravel, sand, and silt, belting the contour of the base, and then wending their course over the plain. Were these surveyed and mapped they

would lead to important and valuable conclusions. The two principal excavations on the hill are kept open for the purpose of supplying the surveyor of roads with materials. The Marlstone is sometimes used in the parish roads to form a foundation, which, with a facing of Bristol stone (Carboniferous Limestone), is considered to be an economical and inexpensive method of road making.

SOUTH QUARRY. In the south, or larger quarry, the beds lie horizontally or nearly so, and exhibit but slight traces of disturbance. The following section will exemplify the Communis beds, No. 1 :

§ 1.] **COMMUNIS ZONE AT CHURCHDOWN.—SOUTH QUARRY.** [Dip N. 8°.

	LITHOLOGY.	Thickness.	ORGANIC CONTENTS.
Zone of Ammonites Communis.	1 Alluvial Soil	1 6	
	2 Brown Marly Clay....	2 0	Fish, Crustacea, all the Fossils of the list save the specified exceptions.
	3 Concretionary Argillaceous Limestone ..	4—6	Fish Bed, <i>Leptolepis concentricus</i> , &c.
	4 Mottled Blue and Drab Clay	6 0	Fossils of No. 2 Alga Bed.
	5 Brown Marly Shale ..	1 0	Leptæna Bed, Brachiopoda, Nuculæ.
	6 Blue and Yellow Clay..	1 0	Ammonites <i>R. pygmaea</i> , <i>T. globulina</i> , <i>B. acuarinus</i> .
Ammonites Spinatus.	7 Light coloured Marlstone, and Nodular bed of Marlstone Series ..		Belemnites, frequent.

The last layer, No. 6, of the section (blue and yellow clay), is frequently chequered with an orange coloured matter, or stain of peroxide of iron, combined with silicate of alumina. It contains numerous Ammonites, either much compressed or else in casts, that are beautifully sharp and true. These Ammonites appear to be slightly bent, as if pressure had been applied obliquely and irregularly. This is the bottom bed of the Communis series, and rests upon a bed of light coloured friable Marlstone, containing a course of large Nodules, which I shall designate hereafter as the Nodular Bed. The next member, ascending, is the Leptæna Bed, (*la Couche à Leptæna*, Deslongchamps) made so well known at Ilminster by Mr. MOORE, and at May, in the Calvados, by M.M. DESLONGCHAMPS* Here a new order of zoological facts presents itself. A new fauna occurs. Nature, strange to say, has here resumed an old world type, has taken a form from those old

* The discovery of the Leptæna Bed in the vicinity of Caen, presents so good an instance of what Dr. Whewell (Philos. Inductive Sciences, vol. ii, p. 30) terms "The Colligation of Facts," that I may be pardoned for citing M.M. Deslongchamps' account. They say, "Les nombreuses analogies existant entre les couches d'Angleterre et celles de Normandie, qui font partie toutes deux d'un même bassin, le bassin *anglo-parisien*, nous faisait espérer de rencontrer dans les environs de Caen la couche qui avait fourni ces coquilles si remarquables." —Bulletin de la Soc. Linn. de Normandie, vol iii. Acting on this impression, M. Ferrier hit upon the bed at May, whence the Deslongchamps traced it through Evreux, Landes, and Cury.

Orthids, that abounded in palæozoic seas. Before recent researches brought this bed to light, scarcely a couple of Brachipods were known in the whole Upper Lias; now, thanks to Messrs. BOUCHARD, DAVIDSON, MOORE, and the DESLONGCHAMPS, more than thirty species have come to our knowledge. In truth, it forms a notable example of "recurrency,"—one of those *special* cases that bear so strangely on the generalizations of the palæontologist, namely, that in all times and epochs, continuity of land, of sea, and sea-depth, produce continuity or extension of life. And whenever there is discontinuity or separation of land or sea, the opposite sides of the barrier are inhabited by different races. (Quarterly Jour. Geo. Soc., v. xv. p. 294.) We must not pause, tempting though it be, to speculate. To describe this bed.—Its constitution is a fine sandy friable shale, the particles so comminuted, that it may be crushed between the fingers. Touching the organic contents, they will be seen, by reference to my incomplete list, to embrace among others examples of the genera *Leptæna*, *Spirifera*, *Terebratula*, and *Nucula*. The smaller Mollusca prevail toward the top of the bed, diminishing in number downwards, and giving place at bottom to the larger, such as Ammonites, and occasionally a Belemnite. With regard to its extent, I have detected it at three points on the hill, bearing from each other in angular directions; a fact which firmly convinces me of its persistency over nearly the whole entablature of its summit. On the top the *Leptæna* bed is bounded by a film or crust of the before-mentioned orange-coloured substance, about one-eighth of an inch in thickness; thus marking a convenient and distinct boundary line. Above this line comes a layer of clay, which does not differ materially from the Marly clay above the Fish Bed. The layer, No. 4, is rather Marly in the upper part, owing to the great proportion of lime it contains. Below, the clay shales assume more of an unctuous nature, and do not divide readily into laminæ, as do those in the other quarry; when separated, the surfaces often present a puckered and mammillated appearance. The *quasi* Fish Bed has now to be noticed. I qualify it with this prefix, since the organic contents of it differ neither in kind nor degree from the clay shales lying under and over. If the appellation Fish Bed be used, it must stretch with some elasticity over eight feet or more. This is probably the case with all three of the so-called Lias Fish Beds; those of Wainlode and Westbury will recur to the minds of geologists as analogous instances. The Fish Bed, then, thus qualified, applies to a stratum taking an irregular course, sometimes tending towards the top soil, but mostly pursuing a midway direction through the eight feet of clay and shale (Nos. 2 and 4). It is composed of a yellowish argillaceous Limestone, of concretionary nature, opening to the hammer with a fœtid odour, whence the term *Stink-stein* of the Germans; towards the centre it is siliceous, exceedingly hard, and of

a dark grey or bluish tinge, generally free from any organic nucleus. The fossils are contained either in those portions that are most argillaceous and which have striation; or else on the exterior of the concretions. Their formation, like that of most nodules and concretions, is due to the segregation of particles, the agency being Molecular attraction. It may not be deemed inapposite to quote a valuable passage bearing on this point from the work of a gentleman whose name we have the honour to inscribe on the muster roll of our Cotteswold Society.

Professor DAUBENY, in his treatise on the Atomic Theory, Ed. 2, p. 314, 1850, speaking of cohesive attraction, says, "Such a force seems to be evinced in several well-known phenomena. It is shewn, for instance, in the tendency which camphor and other volatile substances have, when they sublime to collect around certain nuclei, on the surface of the containing vessel, instead of spreading themselves equally throughout. It is evinced also, if it be true, that an intimate mixture of finely comminuted clay and sand, such as is used in the common operations of pottery, cannot be left together for any length of time, without having the silicious particles collected in certain parts of the mass more than in others." It seems to me a case in point; look at the finely comminuted particles of the shales whence this attractive force has sucked out when of course in solution, all the silica, to form these concretionary geodes. This will be an answer to the question, "Which was the prior formation, the limestone or the shales?" The chances are that the clay was first deposited from a shallow or sluggish water of inconsiderable depth, and, when in a semi-fluid or plastic state, the concretions were then elaborated under the segregating agency of chemical affinity, and the lamination into shales was finally superinduced by the gravity of the overlying mass. These limestones are in the form of elongated geodes, and when calcined or ground, are used for making Roman cements, although those on Churchdown Hill are not worked for the purpose, yet they contain silicate of alumina in the proportion of from 30 to 50 per cent.

Of three analyses of normal types of such argillaceous Limestones from different localities in England, the mean per centage stands thus :

Analytical Estimate.	{ Carbonate of Lime, per cent..	55.
	{ Silicate of Alumina, „ ..	39.5
	{ Oxide of Iron, &c. „ ..	4.5

NORTH QUARRY. The smaller, or North Quarry, is situated about 60 or 70 yards from the larger, and affords a better field of exploration:—the beds are of slight altitude, and are, therefore, easily reached; the shales also are more perfectly laminated, splitting parallel to the plane of the beds, and here the knife comes into requisition more than the hammer. You have simply to detach leaf from leaf to disclose the ripple marks; the Algae spread

out, as left by tidal currents; the Crustaceans that pastured on them; and, again, both fish and fierce Cephalopods attracted by such prey. The beds in this quarry lie horizontally and conformably, except at the westward end, where they are abruptly flexed or bent down by some disturbing influence. Doubtless the basement bed must here drop suddenly from its horizontal direction, on which supposition, the Upper Lias would follow and produce a slight fault, though it scarcely merits the name.

The subjoined section exhibits the beds of this North Quarry :—

§ II.] COMMUNIS ZONE AT CHURCHDOWN.—NORTH QUARRY. [Dip 8° N.

	LITHOLOGY.	Thickness.	ORGANIC CONTENTS.
		' "	
Zone of Ammonites Communis.	1 Alluvial Soil	1 0	
	2 Dark Marly Shale	1 6	Differs little from No. 4.
	3 Argillaceous Limestone geodes.....	4—6	Fish Bed.
	4 Marly Shale.....	7 0	Alga Bed.
	5 Fine Arenaceous Marl.	7—11	Leptæna Bed.
Ammonites Splæstus.	6 Nodular Bed of Middle Lias, with Belemnites in the matrix		

I will restrict my observations on this section to the main points of difference in its lithology, compared with that of the other.

The Limestone Band, No. 3, here takes an irregular flexuose course through a set of dark puce coloured shales, No. 2, and 4, which are exceedingly fissile; under the knife they cut like chocolate, and evince a very argillaceous and bituminous sediment. Some of the finer clay in solution has percolated from above, and deposited a drab film on the surface of the laminæ.

The lamination of the shales becomes more regular and perfect as you approach the limestones. Simple dynamical principles fully account for this phenomenon.

An appropriate name for these shales would be the Alga Bed, albeit names derived from fossils are open to objection. They contain abundance of sea-weeds not uniformly distributed, but aggregated at intervals, as though they had been drifted into certain hollows or gullies. Some of these markings are doubtful, but others are unmistakeable and certainly to be trusted.

There are also portions of what appear to be woody or leathery stems, probably of the larger fucoids, flattened and carbonized. This part of the communis zone is known in Wurtemberg as the *Algen Banks*, so styled from its containing a profusion of the Algae, many species of which are

defined and figured. Throughout England and the Continent of Europe, this bed is also a well-marked Saurian band. Churchdown does not form an exception, the shales there have yielded several reptilian remains, but most of them in too perishable a state to determine specifically. Of these I have exhumed a good tooth of *Teleosaurus*, and part of the scapular arch or coracoid of *Pterodactylus*, from the shales. Coprolites are common, as are also remains of a Crustacean, referred by naturalists to the genus *Coleia*, of the order *Podophthalmia*; the individuals are crushed and dislocated, fragments of the carapace and pincers lie strewn throughout the shales. Of fish we have disinterred a host of fragments, but of whole specimens very few. My friend, Mr. POWELL SYMONDS, was lucky enough to find in the fish-bed proper, a whole specimen of *Leptolepis concentricus*. The same fish we have met with in the shales. The others perfect enough to be determined are *Tetragonolepis ovalis*, and species of *Dapedius* and *Pachycormus*. The last profusely scattered, both fin and scale.

A small *Echinus* of about three lines in diameter, is not unfrequently met with, either in casts, or sometimes and more rarely with the test itself, though too fragile to be extracted. The long pin-like spines belonging to this urchin ($1\frac{1}{2}$ " in length), are generally lying near it; with great care they may be detached and mounted for microscopic examination, when they form objects of exquisite beauty, and are seen to be delicately serrated.

Before continuing my observations, I will insert a list of the fossils of the zone.

Fossils of the Zone of A. COMMUNIS (Churchdown):

Pterodactylus bone (coracoid)	<i>Ammonites serpentinus</i> , <i>Rois.</i>
Teleosaurus tooth	———— <i>communis</i> , <i>Sow.</i>
Leptolepis concentricus, <i>Eg.</i>	———— <i>var. anguinus</i>
Tetragonolepis ovalis, <i>Eg.</i>	———— <i>var. annulatus</i>
Pachycormus, species	———— <i>var. angulatus</i>
Dapedius, species	———— <i>lineatus</i> , <i>d'Orb.</i>
Coleia (perhaps the <i>Thrissops micro-</i> <i>podius</i> of <i>Agassiz</i>)	———— <i>Brood</i>
Acrosalenia crinifera, <i>Wright</i>	<i>Belemnites tubularis</i> , <i>Y. and B.</i> (<i>B. acuaris</i> , <i>Schloth.</i>)
Pentacrinus gracilis, <i>Charlew.</i>	<i>Belemnosepia</i> , <i>osselet</i>
Ammonites Margaritatus, <i>Montf.</i>	———— <i>pigment-bags</i>
———— <i>Jurensis</i> , <i>Ziet.</i>	<i>Aptychus Lythensis</i> , <i>Pictet.</i>
———— <i>bifrons</i> , <i>Brug.</i>	<i>Aptychi</i> of the group <i>Cornei</i> , <i>Pictet.</i>
———— <i>Raquinianus</i> , <i>d'Orb.</i>	<i>Rostellaria trifida</i> (<i>Alaria</i> of <i>Morris</i> and <i>Lycett</i>)
(= <i>A. crassus</i> , <i>Phil.</i> , according to <i>Marcou</i>)	<i>Turbo capitaneus</i> , <i>Münster</i>
———— <i>Lythensis</i> , <i>Y. and B.</i>	<i>Rhynchonella pygmaea</i> , <i>Morris</i>

T. globulina, *Dav.*
T. Lycetti, *Dav.*
T. numismalis, *Zist.*
Spirifer Münsteri, *Dav.*
 ——— *Ilminsterensis*, *Dav.*
Leptæna Moorei, *Dav.*
 ——— *liasiana*, *Bouch.*
 ——— *granulosa*, *Dav.*
Inoceramus dubius, *Sow.*
Mytilus gryphoides, *Schloth.*
Monotis substriata, *Goldf.*

Posidonomya Bronni, *Volta.*
 (*Posidonia Bronnii*, *Münst.*)
Plicatula spinosa, *Sow.*
Ostrea (Gryphæa) ocreata, *Deul.*
Arca inæquivalvis, *Goldf.*
Cucullæa Münsteri, *Zist.*
Nucula inflexa, *Quenst.*
 ——— ovum, *Sow.*
Fucoides Bollensis (*Chondrites*)
Quenst.
 Algae, several species undetermined
 Coprolites, Lignite, and Driftwood.

It will be thus seen that the cephalopodous swimming molluscs were well represented. Predacious in their habits, they have congregated in pursuit of the smaller Crustacea. My list includes the keeled osselet of a *Belemnonepia*, and well-preserved inkbags, the pigment therein not deficient in richness of tone, and of a quality worthy a place in the artist's colour box. These remains on very questionable grounds have been attributed to *Acanthoteuthis*, an apocryphal genus of Münster. In general the fossils are but indifferently preserved, the *Testacea* have merely left their impress in the clays; but the shell more often remains in the arenaceous strata; the cause of this has been already briefly touched on and suggested.

The Ammonites are numerous in some beds, almost absent from others, they lie chiefly in the underpart of the *Leptæna* bed, and mostly belong to the section *Falcoferi*. Two or three specimens of *A. lineatus* belong to the Limestones. On the whole there is a paucity of *Belemnites*, a genus so plentiful in the under stage, when found here individuals are but of diminutive size, and located towards the basement bed.

The very few Gasteropods are scarce, delicately sculptured, and almost confined to the mottled clays under the *Leptæna* bed. The Conchifera are small in size, the largest species is *Inoceramus dubius*, a fragile shell ranging throughout, and characteristic of the limestone and shales of the zone.* The Brachiopoda are also of small dimensions, they prevail mostly in the *Leptæna* bed. *Terebrat. numismalis* is scarce; the two specimens I found have the marginal line rather less curved than the shell figured in DAVIDSON (Brach. p. 5. fig. 7). Mine, perhaps, may be younger than that figured in his monograph.

* So much so that some geologists have suggested the propriety of designating the strata through which it ranges, the *INOCERAMUS ZONE*. It is evident, that if *M. gryphoides* is distinct from *I. dubius*, the expediency of the proposed appellation becomes sensibly weakened.

R. pygmaea is the Brachiopod most conspicuously present, followed by *T. globulina*, and *Leptæna*. That characteristic shell, *Posidonomya Bronni*, occurs in the blue clay associated with *Nucula*, under the *Leptæna* bed, but is comparatively rare in the shaly portions. It is a question whether pressure and percolation may not have obliterated so thin and frail a shell. Still, on the other hand, we find in the Oxford clay impressions and traces of the same bivalve beautifully distinct. *Nucula inflexa*, of Quenstedt, is rare; it is a charming shell and has more the external appearance of *Leda*, posteriorly at least. Here it is the only representative of the *Arcadae*; and suspicion is not wanting that this *Nucula* is identical with the *Nucula Hausmanni* of ROEMER, cited by Mr. LYCETT, as procured by him from an exposure of the Upper Lias shales at Nailsworth, since covered up. *Mytilus gryphoides* is a well-marked fossil of the Limestones, though ranging above and below them. It is not unapt to be confounded with the *Inoceramus dubius* of SOWERBY, but no two fossils can be more distinct either in outline or growth. Briefly, the smooth tumid or rather pouched form clearly belongs to the *Mytilidae*, and is no *Inoceramus*. It is fair to state that OPPEL entertains a faint doubt (v. Juraformation, § 32, p. 261). With more time and favourable opportunity, I feel convinced that I shall be able considerably to increase my list of fossils of the communis zone at Churchdown. This addition will be chiefly in the minuter forms of the Brachiopoda of the *Leptæna* bed; *Thecidia* for example, which on account of their diminutive size, cannot be safely and readily defined without ample time and patience.

Reference may here be made to the dwarfed size of the organisms of the zone, as though starvelings of a larger race, that came from a distance, and struggled for existence. Whether the waters of our liassic estuary were deficient in a normal percentage of salt is a view not unworthy our consideration. Such a cause would adequately suffice to degenerate the mollusca inhabiting them. Russian naturalists tell us that while oysters, for instance, are found in the Mediterranean, the Atlantic, the North Sea, and the northern part of the Cattegat, they do not occur in the Baltic Sea, and refuse to be naturalized there. To accord with this, the oyster cited in my list, is almost a solitary example, not an inch in diameter. The waters of the Mediterranean contain 3.7 per cent of salt; those of the Atlantic 3 to 3.6 per cent; the north of the Cattegat 1.8 to 2 per cent; while the saltiest part of the Baltic yields only 1.7 per cent. of salt. In Professor E. FORBE's "Travels in Lycia," 1847, it is mentioned that a gradual change in fossil marine species of Mollusca was observed by the writer in some coast sections of the Island of Cos. The deviations in form evidently arose from the influx of fresh water. Every Algologist must have noticed the stunted dimensions of such marine Algae as

contrive to live in brackish waters, or in saltwater commixed with a large proportion of fresh. A specimen of a given plant, gathered in pure salt water, and placed by the side of the same plant taken from brackish streams, would only be recognized as identical by an experienced botanist conversant with the method of gradation. The waters of the ocean then, when reduced in their due quantity of saline matter, have, undeniably, the power of dwarfing the marine forms of animal and vegetable life, and seem to have done so here; transmitting us a puny diminutive fauna.

On a retrospect of this outline of the communis zone as exemplified at Churchdown, we cannot scruple to admit that these beds, reduced as they are by erosion to narrow dimensions, still retain considerable attractions for the scientifically disposed, and are not only poor in organic contents, but little short of typical, synchronizing well with the same zone in very remote parts of the Continent, as well as in localities near our own district. This is true of the Somersetshire beds, of those in the Calvados, Würtemberg, and the south-west of Germany. In fact, in every country, according to that distinguished geologist, M. FRASS, this subdivision, so sharply and distinctly divided from the Spinatus beds or Marlstone series forms "a good geological horizon."

NOTES ON CALMSDEN CROSS.

BY CHARLES POOLEY, Esq., OF WESTON-SUPER-MARE.

IN continuation of my Notes on the Ancient Crosses of Gloucestershire, I have now to add a few remarks on the way-side Cross at Calmsden, an illustration of which is given in the accompanying plate.

✓ n The Cross, in all probability, is as old as the time of the Knights Templars. There is no historical evidence that I know of to support this opinion ; but quaint chronicles tell us that the Preceptors of the Knights Hospitallers of Jerusalem at Quevington, only a few miles distant, held large possessions at Calmsden, being the several gifts of Mabel the wife of William de Mara, and of Richard the son of Robert de Calmsden ; and I conceive it is more than likely, that this Cross was erected there, not only to mark the tenure by which the lands were held, but also to shew by whom the manorial rights and privileges were exercised. There is something also in the building itself, grey and weather-beaten as it is, which conveys to the eye an idea of chasteness in the design, such as we are accustomed to associate with monuments of this description appertaining to the early part of the fourteenth century. The structure consists of four steps, and a pedestal or socket, into which is inserted a taper sexagonal shaft, surmounted by a cube, whose sides face the four cardinal points.

The site of the Cross is extremely well chosen. Elevated on a rising slope, on the north side of the glen, it stands out a conspicuous object from whichever side it is approached, and the visitor cannot fail to be struck with the beauty of this sequestered nook, shaded as it is by the luxuriant foliage of some fine old elms.

Close adjoining the road stand some watering troughs, supplied by a deliciously cool spring of water, which gushes out from the rock immediately below the Cross. At these troughs, as we turned to leave, the horses of a neighbouring farm were brought to be watered before they were housed for the night, while two or three urchins who had them in charge clustered about the old pedestal, as clearly innocent of its emblematic significance as they were of the contrast they presented to our minds, as our thoughts travelled back to a scene which was once doubtless familiar enough five centuries ago at the same spot, when the haughty Templars, with their chain mail, and snowy vest, and red cross, bent the knee in silent adoration to this symbol of their faith.



C.P. del.

M. & N. Harburt. lith.

CALMSDEN CROSS

*Annual Address, read at the Ram Inn, Gloucester,
Wednesday, 26th February, 1862, by W. V. GUISE,
F.L.S. F.G.S. President.*

GENTLEMEN of the Cotteswold Club, — In accordance with our established custom, it becomes my duty at this period of the year to lay before you a report upon the condition and prospects of our Society; and it is encouraging, at this the commencement of another season, to be able to assure you, not only of the undiminished health and vitality of the Club, as testified by our still increasing numbers and by the greater amount of interest and intelligence brought to bear upon the different subjects of our research, but still more cheering is it to find a marked improvement in the number and quality of the papers read before us at our periodical meetings. In this latter respect, the past season will compare advantageously with any of its predecessors, and, indeed, bids fair to mark a new epoch in our existence. I attribute this improvement in some degree to the more earnest spirit by which we have been animated; but more particularly to the influence of the Resolution adopted at our annual meeting, at Tewkesbury, last year, when a Committee was appointed for the purpose of superintending the printing of our papers, and with a view to prepare for publication papers and figures in illustration of original communications on the Geology of the Cotteswold District. To the latter portion of this resolution, in especial, I attach great value and importance. And though various circumstances have operated to cause a delay in carrying it into effect,—prominently amongst which I may mention the difficulty of finding skilled artists to undertake the work,—yet the matter has been carefully kept in view by your Committee, and there is reason to believe that such arrangements may shortly be completed as will ensure the practical operation of a design which is calculated to be of so much service to Geological science, and which cannot fail to confer honor upon the Cotteswold Club. It is proposed to publish from time to time Monographs of the different families of fossil invertebrata characteristic of the Cotteswold district. Of these Dr. WRIGHT has undertaken

the *Cephalopoda* and *Echinodermata*—groups with which he is peculiarly conversant. Our Secretary, Mr. JONES, offers to devote himself to the elucidation of the *Myadæ*, *Gryphæadæ*, and others of the *Conchifera*, of which he has made a particular study; and our accomplished colleague, Dr. LYCETT, has expressed his willingness to undertake some of the genera not included in the foregoing groups. Thus by degrees we may hope to possess complete illustrations of all the forms which characterise our local deposits, cleared of the confusion of synonyms—a guide to our local Geologists, and a standard of reference to all workers in the same field elsewhere.

This leads me, while regarding with pleasure the continuous efforts made by our Club to advance the study of Geological science amongst us, again to draw your attention to a point in connexion with our mission as a scientific body, upon which I have commented on a former occasion, and which I again desire to urge upon your notice. It cannot be doubted that the domain of Nature in Gloucestershire is equally prolific in subjects for study and elucidation in the realms of animal and vegetable life, as we know that it is in those mineral treasures which the labors of our members have so ably and extensively illustrated. How happens it, then, may I ask, that so few of us devote ourselves to the observation and registration of facts of so much local interest and importance, the gathering of which seems to lie at the door of every Naturalist amongst us. The answer must be, either that many amongst us are not Naturalists in the true sense of the term, or else that they are too indolent or too indifferent to devote time and attention to these subjects. I am far from believing that every lover of Nature is a good and original observer; but it is in my view one of the chief objects of our association to stimulate and develop habits of observation and analysis which may find employment in the investigation of the infinite variety of forms, habits, and instincts with which the vital principle is associated; and by affording a ready medium for the registration of facts to co-operate with local observers in securing and giving value to their labors. Having regard to these objects, and knowing how much such enquiries are aided by association, I took advantage of my induction into your Presidential Chair to suggest the desirability of forming Sections, whose duty it should be to apply themselves especially to the examination of those branches of Natural Science to which they might respectively be attached, and in particular to draw up lists of the local "*Fauna*" and "*Flora*" of the county, which have as yet met with no systematic expositors.

From our friend and colleague, Professor BUCKMAN, I continue to

receive annual reports of great interest upon the good work which he is carrying out in his experimental garden at the Royal Agricultural College, at Cirencester; and through his kindness I am enabled to annex such a report to this address. It is my earnest desire to encourage similar reports and records of facts occurring in other departments of the vast realm of organic life: and to facilitate this, I would suggest that Sectional Committees shall be formed, whose duty it shall be to collect observations, draw up local lists, and make report of such phenomena as may be deemed worthy of record. From the active exertions of such Committees, if carried out in a loving and energetic spirit, I cannot but anticipate very useful and valuable results.

With these prefatory remarks, I will proceed to describe the operations of the Club during the past season.

The Annual Meeting was held at the Swan Inn, Tewkesbury, on Tuesday, 26th February, when you did me the honor to re-elect me as your President, with Mr. JOHN JONES as Secretary. After the transaction of the usual routine business of the Club, the party walked to Brockridge Common, visiting by the way the "Mythe Toot," from whence the ancient lake-beds of the Severn, with their wide expanse of lacustrine drifts, are well seen. The "Mythe Toot" owes its elevation to a "fault," extending along the line of the Severn for some distance in the direction of Ripple; the Keuper Marls being elevated through the Lias which is developed at Sarn Hill and again beyond the "Toot," south of the line of fault.

Between "the Mythe" and Brockridge, the party examined the gravel-beds resting on the Keuper and Lias. These belong to the marine drifts of the old Severn estuary, which at many points have furnished the remains of *Elephas primigenius*, (Mammoth,) *Bos primigenius*, and *Rhinoceros tichorhinus*.

At Brockridge, the Lias quarries were examined, and compared with Dr. WRIGHT's Section, as given in his valuable paper on the Lias of the South of England. The Rev. W. S. SYMONDS drew attention to certain concretionary nodules charged with fossil shells and Saurian remains, which he stated were derived from the lowest beds of the Lias at their point of contact with the Red Marl. These he considered to be the equivalents of the "Bone-bed" of the "*Avicula-contorta*" series. He stated that he had found similar nodules at Sarn Hill and elsewhere, occupying the same relative position to the under-lying beds.

From Brockridge the party directed their steps to the village of Ripple, placed on a line of fault extending northwards along the

Severn, which occupies the line of fracture. At this point the "Keuper Sandstones," and even some beds of the "Lower Keuper," are faulted up between the Lias of Queen-hill and that of Brockeridge.

From Ripple the party returned by the Ripple Brook, and over Shuthonger Common to Tewkesbury.

After dinner, the PRESIDENT read the annual address to the Club ; which was followed by a discussion respecting the advantage of organising a Publishing Committee, with a view to increasing the scientific value of our Transactions. The PRESIDENT, Dr. WRIGHT, and the SECRETARY addressed the Club on the subject ; and on the motion of Dr. WRIGHT, seconded by Mr. HEFORTH, the following resolution was adopted :—" That a Committee of five be appointed, whereof the PRESIDENT and SECRETARY for the time being to be ex-officio members ; three to constitute a quorum ; for the purpose of preparing for publication original papers and figures in illustration of original communications on the Geology of the Cotteswold District."

A paper was read by the Rev. S. LYSONS, on " Certain Local Names connected with Gloucester and its vicinity."

The PRESIDENT exhibited a stuffed specimen of the Slavonian Grebe,—"*Podiceps cornutus*," Pen.—which was shot in the neighbourhood of Elmore, in the month of March, 1860. The individual referred to was in the winter garb, in which condition it has been designated the " Dusky Grebe," and as such was regarded as specifically distinct from *P. cornutus* by the earlier Naturalists. This bird is but occasionally met with in England, and on our Western coasts appears to be of extremely rare occurrence. Indeed, in so far as I have been able to discover, the present is the only recorded instance of its occurrence on this side of England, which renders its discovery in Gloucestershire a fact of much interest in the records of our local fauna.

At this meeting the following gentlemen were elected members :—

Mr. HENRY BEACH, Surgeon, Cheltenham.

Captain BELL, Chalfont Lodge, Cheltenham.

Wednesday, 15th May.—The first Meeting of the season took place at Chipping Sodbury. The principal object of visit was the fine camp at Little Sodbury, which, from its extent, commanding situation, and double line of entrenchment, was evidently at one time a military position of considerable importance. In common with the other long line of ancient forts which command the course of the Severn, it has been usual to attribute the erection of the one in question to the Roman General Ostorius Scapula, whose forces may very probably

have occupied it; but it is at least as probable that it may have been a place of strength in days prior to the Roman occupation, and after them may have received additions and alterations at the hands of Dane or Saxon.

This day's rambles embraced a visit to Little Sodbury Manor, an ancient seat of Sir JOHN WALSH, in whose family TYNDALL was tutor, and in which house he wrote his translation of the New Testament; and to the old and interesting Manor House at Norton, where the party were hospitably welcomed by the proprietor, Captain LUMLEY. The retired situation and antique lineaments of this place seemed to denote a conventual origin, to which a door-way, with a chevron moulding of the early part of the 12th century, tended to give further confirmation: which, however, is not borne out by the well-ascertained facts of the case. In the opinion of Antiquaries, we have in this building vestiges of one of those early manor-houses coeval, perhaps, with the Norman Conquest, of which so few traces are now to be found.

The party dined together at the George Inn, Sodbury. After dinner, a very interesting paper, by Dr. LYCETT, was read, on "The Ammonites of the Sands intermediate the Upper Lias and the Inferior Oolite." This paper, by so eminent an authority, is an extremely valuable addition to the literature of the subject on which it treats. It is one, moreover, which has engaged the attention of our learned colleague during many years past, and on which no other Geologist is competent to speak with greater authority.

These Ammonites of the "Supra-liassic Sands" are of great importance as affording a valuable medium for determining the relation of these beds to those above and below. And it was in that view especially desirable that the subject should be cleared of the obscurity of synonyms, as well as of the confusion arising from the undue multiplication of species,—on both which points Dr. LYCETT's paper does good service. Plates, however, are absolutely necessary for the due discrimination of the points treated of. In proof of which it will be sufficient to state, that only three species from the sands have been figured in any English work, and those insufficiently. *A. Aalensis* is described with its varieties at more than usual length. Dr. LYCETT informs me that the whole of this matter is new. The species is *special* to the "Sands," and at no other spot in England, except at Frocester Hill, can a good illustrative series of its varieties be obtained.

From what I have here stated, the Club will probably deem it desirable that no time should be lost in publishing the necessary

figures to illustrate Dr. LYCETT's paper ; and I would suggest that it should be one of the first objects to which the Publishing Committee should direct their attention.

On Wednesday, 12th June, the rendezvous of the Club was fixed at the Feathers Inn, at Lydney, from whence they visited the beautiful and interesting grounds of Lydney Park, which the owner, CHARLES BATHURST, Esq. had kindly thrown open for their inspection. In the garden, attention was drawn to the noble Spanish Chestnuts, and to some very fine Orange-trees, reputed to have come from Margam, where the stock is said to be derived from the wreck of a Spanish vessel. Passing from the gardens, the party examined all the places where the Old Red Sandstone rock crops out on the right in the park, tracing it to the corner of "Hope's Bottom," and thence to the turn of the "Rocky Walk." The richly wooded eminences, commanding extensive and varied prospects over the Severn and the country beyond, together with the vestiges of a Roman encampment, occupied the time and attention of the visitors to such an extent as seriously to curtail their leisure for the work that was in front of them, some of which was in consequence left undone, to be completed, let us hope, on a future day.

In a road-cutting, at Sandford, a very remarkable fault in the Old Red Sandstone was exhibited. The Strata dipping in opposite directions, to the N.E. and S.W. In the latter case, the effect is traceable beyond Coleford, as governing the position of the coal in all that part of the Forest. Traces of igneous action are apparent at the point of fracture, in the altered condition of the rock and the roasted appearance of the quartz pebbles,—from which indications some of the Geologists present thought it probable that trap rock might lie at no great distance from the surface.

The diluvial Clays and Gravels in the neighbourhood of the Church were next examined. It is apparent that a bay of the river formerly came up near to the Church, to the bank now called "the Territt," depositing the blue clay of "the Mead." The Church stands upon gravel, which has been mainly derived from the Coal formation, but exhibiting evidence of more remote water-action in the fragments of chalk-flint distributed throughout its substance.

At the new Gas-works, close to the town of Lydney, the party came upon a gravel which was not merely ferruginous, but contained iron-ore in great abundance, varying in size from small grains to pieces several pounds in weight ; derived, of course, from the degradation of iron-bearing strata under the erosive force of water-action of vast intensity, and probably of long duration.

This question of gravels and drifts, which has of late, owing to the researches of Mr. PRESTWICH and others, attracted a large share of attention, is amongst the most interesting and the most intricate of the problems which remain for solution: as it is probable that diluvial action may have disturbed and re-arranged the same gravels more than once. How otherwise can we account for the presence in the same deposit of minerals derived from the most opposite sources, and which must owe their transport to forces acting in directions entirely diverse and often over spaces immensely distant?

After dinner, which was served at the Feathers Inn, an account was communicated by the Rev. F. SMITHE, of certain "*Bryozoa*" beds underlying the "Fish-bed" at the base of the lower Carboniferous Shales in the Avon Section, near Clifton. These beds were described as being 12 feet in thickness, and as absolutely teeming throughout with minute organisms of the Class *Bryozoa*. These, freed by hydrochloric acid, form 70 per cent. of the rock. It appears that this bed has been overlooked by the Ordnance Surveyors, and allocated to the Devonian System, whereas it is highly crystalline limestone of the Carboniferous Series, and reposes on the Upper Red Conglomerates. Some of these organisms from the *Bryozoa* bed have been since described and figured in the "Quarterly Journal of Microscopical Science."

Wednesday, 17th July.—The Club met at Corse, having accepted an invitation from our friend and colleague, the Rev. W. S. SYMONDS, to partake of luncheon at his residence, at Pendock. The party proceeded, under his guidance, to examine the interesting undulations in the "Red Marl" above the village of Eldersfield, visiting by the way the wooded knoll of Berth Hill, from which the Lias has just been denuded, and the flat plateau of "Gadbury," where the traces of a rude and early encampment have given rise to the belief that the hill owes its flatness to the levelling hands of the rude engineers who first fortified its summit. But the rolled pebbles of undisturbed drift on the surface seem rather to point to the sea as the true leveller, in those remote epochs of the world's history when the broad vales of Gloucestershire and Worcestershire formed part of an ocean which stretched from the Mersey to the Severn: and the rounded hills, capped with gravel, were shoals in that wide waste of waters.

A large party, including representatives from most of the neighbouring Field Clubs, with a goodly proportion of the fair sex, were handsomely entertained at luncheon by Mr. and Mrs. SYMONDS; after which the Rev. Mr. TIMINS, Rector of West Malling, Kent, gave an interesting address on the Mineralogical Chemistry of the

Malvern rocks. He detailed the results of a series of carefully conducted experiments on the rocks in question, from whence he had been led to the conclusion that water had far more to do with the formation of the "Traps" and "Sienites" of the Malvern range than fire.

This subject of Chemical Geology is one which has at all times occupied a large share of attention; and has of late assumed greater prominence from the experiments carried on, principally by French and German Chemists, with a view to ascertain the share borne by aqueous and igneous action in the production of crystalline and so-called "metamorphic" rocks. Mr. LEONARD HORNER, in his Presidential Address to the Geological Society, read on the 15th of February last, and published in the "Quarterly Journal" for May of that year, goes at considerable length into a comparison of the latest views promulgated upon the subject. And though he hesitates to come to any distinct conclusion upon the matter, beyond urging the importance of continued experiments, he adduces a large body of experimental evidence showing the important part which water has probably borne in bringing about the phenomena known as "metamorphism" in rocks. One experimentalist, M. DELESSE, seems to advocate views very similar to those put forward by Mr. TIMINS, affirming that "the agencies in general metamorphism must have been heat, water, and pressure;" and further attributing the formation of the traps of the Giants' Causeway, in Ireland, and of Meissner, near Cassel, "rather to an aqueous than an igneous action."

It is certainly not a little surprising that we should see revived at this time of day, the questions which, under the names of Wernerian and Huttonian, so agitated the world of Mineralogists and Geologists more than half a century ago. But in problems of so intricate and complex a nature, in which forces and agencies have to be dealt with upon a scale, and under circumstances so difficult to calculate, it is not wonderful that a certain oscillation of opinion should be manifested, which a long series of carefully conducted experiments can alone serve to set at rest.

At this meeting, two rare wild plants were exhibited, the localities of which are deserving of notice. "*Lathyrus palustris*," the Marsh Vetchling, from Longdon Marsh; and "*Turritis glabra*," the Smooth Tower Mustard, from an old wall at Bromsberrow.

Wednesday, 14th August.—The Club met at Beckford Inn, in the Vale of Evesham, for the examination of the Upper Lias Fish-bed at Alderton and Dumbleton Hills. This stratum, which in Somerset-

shire has yielded such a large and important series of fossil fish and other organic remains to the indefatigable hammer of Mr. CHARLES MOORE, is scarcely less prolific at Alderton and Dumbleton Hills, in this county, where the quarries opened in the "Marlstone" have exposed to a considerable extent the "Fish-bed" and its accompanying fossiliferous shales. The party, about twenty in number, headed by Mr. CHARLES MOORE, of Bath; S. T. WOODWARD, Brit. Museum; Dr. WRIGHT, Rev. W. S. SYMONDS, and others, soon got actively to work at the "nodules" and "shales" of the "Fish-bed," and the click of the hammer laid bare to the eye of day strange forms of fish and saurians, that had lain entombed in their rocky sepulchres Heaven knows for how many millions of ages! "*Leptolepis concentricus*" was found by Mr. NORWOOD, a fine "*Pachycormus*" by Mr. HOLLAND, and a series of vertebræ belonging to a species of "*Ichthyosaurus*" by Mr. MOORE.

At Alderton Hill we examined two quarries.

Quarry No. 1.

The Marlstone forms the base of the quarry, and as nearly as could be guessed, the "Fish-bed" is about 25 feet above the uppermost bed of "Marlstone," where it is marked by a chain of nodular concretions projecting from the face of the quarry. In these, scales, teeth, and bones abound, and entire fish are by no means rare, though these seem to be more readily found in the adjacent shales than in the nodules themselves.

This is a true Upper Lias deposit, characterised by "*Ammonites communis*" and "*Lythensis*."

Quarry No. 2.

The following list of Fossils was made on the spot:—

- 1.—"*Acrosalenia spinifera*." The hair-like spines of this urchin were very abundant. They belong to the soft shales between the "Marlstone" and "Fish-bed," and are associated with "Upper Lias Ammonites," particularly the characteristic "*A. communis*."
- 2.—"*Gresslya unionoides*." Marlstone.
- 3.—"*Nautilus*."—Marlstone.
- 4.—"*Ammonites spinatus*." Characteristic of Marlstone.
- 5.—"*Pecten equivalvis*." Ditto ditto.
- 6.—"*Pecten corneus*." Ditto ditto.

At Dumbleton Hill quarry, Mr. HOLLAND found a good example of *Pachycormus* in the shales below the "Fish-bed."

From these quarries the party adjourned to the brick-pits at Dumbleton, which yielded to the explorers a good series of Lower Lias fossils, intermixed with some few of "Marlstone" type,

indicating the presence of true passage-beds between the Lower and Middle Lias.

The following list of fossils from the uppermost beds of the Lower Lias was tabulated on the spot :—

<i>Ammonites Henleyi</i> ,	<i>Modiola scalprum</i> ,
———— <i>maculatus</i> ,	<i>Arca</i> , <i>sp.</i>
<i>Pecten equivalvis</i> , small variety.	<i>Plicatula spinosa</i> ,
<i>Unicardium cardioides</i> ,	<i>Gryphæa gigantea</i> , small variety,
<i>Crenatula ventricosa</i> ,	<i>Annelide perforations</i> .
<i>Gresslya</i> , <i>sp.</i>	

The following rather local plants were noticed by the Botanists of the party on Alderton Hill.

<i>Carduus eriophorus</i> ,	<i>Filago germanica</i> ,
<i>Rumex acetosella</i> ,	<i>Allium vineale</i> .

From the "brick-pits" the party adjourned to Dumbleton House, the residence of Mr. E. HOLLAND, M.P. for Evesham, who had invited the Club to partake of his hospitality. In the interval before dinner, the Geologists availed themselves of the opportunity of examining the large and beautiful collection of fossils from the neighbouring quarries, which have been collected and arranged by Miss HOLLAND, in a manner which does infinite credit to the energy, perseverance, and intelligence which she has brought to bear upon the work. Amongst these relics of an extinct creation were rare and beautiful forms, new to many of the Naturalists present, who, without the opportunity thus afforded, would have gone away with a very meagre conception of the riches of the wonderfully prolific beds from which these fossils had been derived. I am happy to have it in my power to inform the Club that our colleague, Dr. WRIGHT, has, at my request, undertaken the task of drawing up a Catalogue of this collection, allocating the fossils to their respective positions in the strata, and illustrating their history by a careful description of the beds to which they belong. To this proposition Miss HOLLAND has most readily given her consent; and in the hands of so competent a palæontologist as Dr. WRIGHT, I am sure we may look forward to a valuable paper on these Dumbleton beds.

After dinner, two papers of considerable interest were read to the meeting: one by the Rev. W. S. SYMONDS, on "The Drifts of the Severn, Avon, Wye, and Usk;" the other by the Rev. F. SMYTH, of Churchdown, on "The Upper Beds of Churchdown Hill."

This was the final meeting of the season, and, with the exception of a gathering of Naturalists at Worcester, on the 17th of September, was the last occasion upon which the Club met together. On this

latter occasion no Club-business was transacted, and I have therefore not thought it necessary to make any special mention of the proceedings of the day.

Botany.

The following outline of the useful labours of Professor BUCKMAN, in his experimental garden at Cirencester, will be deemed of interest. In the face of much discouragement, he has persevered in his attempts to raise esculent plants from wild seed, and apparently with very remarkable success—a success which appears to be mainly due to the careful attention paid to the various cultivative processes, such as “collecting seed, storing it at a special time and in a selected place,” “instead of at once from the wild plant in a wild locality,”—“selecting roots, storing these from which to grow seed, and so on.”

It will be in the recollection of the Club, that at our annual meeting two years ago, I noticed the fact, announced by the Professor, of his having succeeded in rearing from the wild “*Pastinaca sativa*,” a new variety of the esculent Parsnip, remarkable for its clean growth and fine flavour. The experiments upon this variety have been since continued with marked success by the Messrs. SUTTON, of Reading, in whose hands the new seedling has become an established favorite. Professor BUCKMAN has since extended his researches to other plants, and is now engaged in raising esculent Beet from the wild “*Beta maritima*,” and Broccoli from the wild Cabbage of Llandudno, in both cases with good prospects of success. Some of his more curious experiments have reference to the following postulate:—“*Seeds of a diseased and mal-formed plant produce a poor crop of a more diseased and mal-formed progeny.*” The facts, the Professor adds, are not yet complete, but their results, so far, prove the necessity of seed selection.

He states:—“I am now investigating the causes of decay in Elm trees, to which end I spent much time this season in the London Parks. The result, so far, is to exonerate the ‘*Scolytus*’ as the cause of the mischief from which Town trees suffer.”

Zoology.

The following notes on the appearance in this district, during the past season, of birds of rare or occasional occurrence, are derived from trustworthy sources:—

Honey Buzzard.—*Pernis apivorus*.—Killed at Tibberton, near Gloucester.

Parrot, Crossbill.—*Loxia pityopsittacus*.—One pair killed at Cheltenham, by N. SKELTON, Bird-preserver, of that place, Autumn, 1861.

Solan Gannet.—*Sula bassana*.—In mature plumage. Killed at Fretherne, Feb. 1862.

Slavonian Grebe.—*Podiceps cornutus*.—Killed at Tewkesbury, June, 1862. This bird, though killed in Summer, was in the same immature plumage as that already mentioned by me as having been killed at Elmore in the Winter of 1861. From this it would seem probable that this bird has hitherto escaped more frequent observation from the rarity of its occurrence in the breeding plumage, rather than from the infrequency of its visits to our Western coasts.

With this summary of facts observed and of work done during the past season, I conclude this address. And while heartily thanking you for the renewed mark of your confidence in again appointing me to the honorable office of President, I call upon you all for continued and increased labor and energy, and doubt not, with your assistance, to maintain the credit and extend the sphere of usefulness of the Cotteswold Club.

List of Land, Fluviatile, and Lacustrine Shells found in and near the County of Gloucester, by JOHN JONES, named after "A History of British Mollusca and their Shells," by FORBES and HANLEY. London. Van Voorst. 1853.

UNIVALVES.

NERITIDÆ.

Neritina fluviatilis, Lin. Found of very large size, and very highly coloured, in the Gloucester and Berkeley canal, upon stones within hand reach, at Sharpness Point, and in the Severn, at Wainload.

PALUDINIDÆ.

Paludina Listeri, Forbes and Hanley. In the Newent canal, at Over, and throughout its length. Combe Hill canal.

P. vivipara, Lin. Found in the canal at Cirencester, and in the Stroud canal. Query, Is this more than a variety of the last?

Bithinia tentaculata, Gray. Common throughout the district, in canals, ditches, and brooklets.

Valvata piscinalis, Müller. With the last species, Robin's Wood Hill reservoirs, River Poplar, &c.

Valvata cristata, Müller. At Over, Newent canal, and ditches in Maisemore Ham, on water plants.

LIMACIDÆ.

Arion empiricorum, Ferussac. Woods, gardens, and hedgerows throughout the district, particularly in cloudy warm weather, preceding, during, and immediately after rain, under logs and large stones in shady places in dry weather.

Limax agrestis, Müller. Common everywhere in fields and gardens.

Limax cinereus, Müller. Common in the neighbourhood of Gloucester. In cellars and damp outhouses, under decaying wood, water butts, &c.

Limax flavus, Lin. Common in vaults and cellars.

Limax brunneus, Drap. Woods between Cooper's Hill and Birdlip, in damp places under stones and amongst the decaying leaves.

TESTACELLIDÆ.

Testacella haliotoidea, Drap. Not uncommon in gardens in Gloucester.

HELICIDÆ.

Vitrina pellucida, Drap. Abundant amongst the decaying beech leaves in the Birdlip woods.

Zonites cellarius, Müller. Common under stones, decaying logs, &c. in moderately moist situations around Gloucester.

Z. alliaris, Müller. Common under stones with above, but frequently in much drier localities.

Z. nitidulus, Drap. Amongst moss and decaying wood at Over, between Newent canal and the River Leadon, in moist places.

Z. purus, Alder. Tortworth, with *Helix aculeata*.

Z. radiatulus, Alder. Amongst moss, &c. with *Z. nitidulus*.

Z. nitidus, Müller. Mr. Holford's pine beds, Weston Birt.

Z. excavatus, Bean. Wootton, near Gloucester, with *Z. alliaris* and its allies.

Z. crystallinus, Müller. In Birdlip woods. Amongst decaying leaves and under stones.

Helix aspersa, Müller. Gardens and hedgerows. Common everywhere.

H. pomatia, Lin. Birdlip wood, Witcomb, Miserdine, Colesbourne, and Rendcomb.

H. arbustorum, Lin. Amongst rank and moist herbage, from the banks of the Severn to the woods of the Cotteswolds.

H. cantiana. Hedgerows at Evesham, near the railway station.

H. nemoralis. Hedgerows and gardens. Common, of many varieties in colour.

H. nemoralis var. *hortensis*. Abundant with the preceding.

H. „ var. *hybrida*. Abundant at Tortworth, in hedgerow on the left-hand side of the road leading from the railway station to Lord Ducie's.

H. virgata, Da Costa. On dry and warm commons and banks, in cornfields, &c. Saintbridge, near Gloucester, on the roadside. Generally distributed.

H. caperata, Montagu. On fine herbage. May Hill. Locally abundant.

- Helix ericetorum*, Müller. Common on the Cotteswold Hill-tops, Horsepools, Birdlip, &c.
- H. lapicida*, Lin. Common on the boles of beech trees in all the Cotteswold woods, and on limestone rocks in the Forest of Dean.
- H. rufescens*, Pennant. Most abundant previous to, and during warm summer showers, in the beech woods of the Cotteswold range.
- H. hispida*, Lin. } Under stones, and at the roots of grass; the
var. *depilata*. } varieties, (I think) affecting the drier situations.
,, *concinna*. } Common everywhere.
- H. sericea*, Drap. The variety of this shell, *H. granulata* of Gray, (if it really be merely a variety,) is not uncommon on the banks of the Thames and Severn Junction canal approaching Sapperton Tunnel. I found it in great abundance on the yellow iris, in a moist place in a wood, near the canal in Chalford Bottom.
- H. aculeata*, Müller. Over, on the bank between Newent canal and the Leadon, in the moss and upon decaying willow twigs. Tortworth, in the moss on the bank behind Lord Ducie's garden. Rare. J. J.—Hockley Hill, Elmore, on decayed wood, but very rare. W. V. G.
- H. fulva*, Müller. Common, at Birdlip, amongst decaying beech foliage.
- H. fusca*, Montagu. In a hedgerow amongst burdocks and brambles, near the Roman villa, at Witcomb.
- H. pulchella*, Müller. The ribbed variety, very fine, in the moss fringing the Newent canal, at Over and Lassington. The common species there also, and amongst the decaying beech leaves of the Cotteswold woods, and under stones.
- H. rotundata*, Müller. Abundant under stones everywhere.
- H. umbilicata*, Montagu. Abundant on the Cotteswolds, Birdlip, and elsewhere, on walls and in quarries.
- H. pygmæa*, Drap. Over, in moss, between Newent canal and the Leadon.
- Bulimus Lackhamensis*, Montagu. Ascending the beech trees in the Cotteswold woods, towards the end of March, and descending them about the middle of August. Abundant between Birdlip and Cooper's Hill. Its suppositive scarcity is probably due to its habit of ascending the trees during the summer. I searched in vain for living specimens through many successive seasons, until I became aware of the peculiar habit of this mollusc, in the Birdlip district, where it in reality proved to be most abundant.
- B. obscurus*, Müller. With the last, and in quarries, under stones. Not confined to the hill district, but generally diffused.

Pupa umbilicata, Drap. On liassic stone walls at Lassington, in the lane leading to the hill from Over, and in many similar localities. Common.

P. muscorum, Lin. My specimens of this shell were not obtained from *moss*, but from the withered and grub-eaten boughs of an ash tree, which I broke off, at least ten feet from the ground, by accident, while searching for pupæ of another description. The boughs, which were about an inch in diameter, had been perforated in every direction by a small xylophagous beetle, and in the perforations made I found a great number of the shells in question.

P. secale, Drap. Plentiful in stony districts. In any quarry on the Cotteswolds.

P. edentula, Drap. Amongst dead leaves, Birdlip, Witcomb, &c. Over, Newent canal banks, in moss.

P. pygmæa, and var. *alpestris*, Drap. Forbes and Hanley say, "It may be taken in great numbers by laying a piece of old wood upon the grass at nightfall, and examining it in the morning." My specimens are chiefly from Over, between the canal and Leadon, and moss on canal banks, near Sharpness.

P. antivertigo, Drap. Same locality as above.

P. pusilla, Müller. In damp moss in the fields on the upper lias at Birdlip, Cooper's Hill, and near Sharpness Point.

Balea fragilis, Drap. Matson, in a small grove between the church and the entrance to Mr. Butt's farmyard, under the loose bark of the horse chestnut trees.

Clausilia laminata, Montagu. On beech trees. Common at Birdlip.

C. plicatula, Drap. Birdlip, in the wood, at the base of the oolitic formation, amongst or near to patches of *Chrysosplenium*.

C. nigricans, Maton and Rackett. Common with *C. laminata*, under stones, and upon stone walls and trees, throughout the district.

Zua lubrica, Müller. Under stones, in moss on banks of canal and in fields at Birdlip.

Azeca tridens, Pulteney. With above, particularly abundant in some seasons on the canal banks.

Achatina acicula, Müller. Barnwood, at the roots of grass, in a large field through which the brook runs, between the church and Gloucester.

Succinea putris, Lin. On aquatic plants and mud near small streams. Common. Over, on the banks of the canal where var. *Pfeifferi* is very common.

LIMNÆADÆ.

- Physa fontinalis*, Müller. In clear ponds, ditches, and streams, throughout the district.
- P. hypnorum*, Lin. In slow streams and shallow ponds with much weed. Hempstead, in the field leading to Podgmead. Over, in a ditch near the Butts.
- Planorbis corneus*, Lin. Ditch in Maisemore Ham, very large and common. Combe Hill canal.
- P. albus*, Müller. With foregoing, and in Newent canal, Over, on potamogeton.
- P. glaber*, Jeffreys. Locality uncertain.
- P. nautilus*, Lin. In a small clear pond, full of weeds, cresses, &c. in the field next to Witcomb's mill at Barnwood, between it and Saintbridge, nearly close to the hedge nearest Gloucester.
- P. carinatus*, Müller. Maisemore Ham ditch; Newent canal.
- P. marginatus*, Drap. ,, ,, Common everywhere.
- P. vortex*, Lin. ,, ,, Very common in Fairford and Cirencester district.
- P. spirorbis*, Lin. In small weedy ponds round Gloucester; Podgmead, Hempstead.
- P. contortus*, Lin. Maisemore Ham, Newent canal, Over. More common in Fairford and Cirencester districts.
- P. nitidus*, Müller. Very good specimens in a pond at Barnwood, lying in a direct line between the church and mill above mentioned, and about half-way between them.
- Limnæus pereger*, Müller. The commonest shell of the tribe in ponds, ditches, &c. near Gloucester, Barnwood, and Hempstead.
- L. auricularius*, Lin. Combe Hill canal, Stroud canal.
- L. stagnalis*, Lin. Maisemore Ham ditch, Combe Hill and Newent canals. Very common and large in stream at Kempsford, and in ditches at Siddington.
- L. truncatulus*, Müller. In the Poplar at Upton St. Leonards, and most of the small brooks near Gloucester, in the most rapid parts of the stream.
- L. palustris*, Lin. Maisemore Ham. Common in the Fairford and Cirencester districts, where it appears to attain to a much larger size than in the vale.
- Aneylus fluviatilis*, Müller. Severn, at Wainload. On stones in the brook which crosses the Birdlip road, at Wootton. Canal, at Sharpness Point.

Aneylus oblongus, Lightfoot. In the old fishpond of the Great House at Churchdown.

CYCLOSTOMIDÆ.

Cyclostoma elegans, Müller. Amongst moss, under the hedgerows, at Birdlip, and on the hill-tops in that neighbourhood.

AURICULIDÆ.

Carychium minimum, Müller. Moss on canal banks. Decaying leaves in woods. Common.

BIVALVES.

CYCLADIDÆ.

Cyclas rivicola, Leach. Newent and Berkeley canals. Combe hill canal. Severn, Wainload.

C. cornea, Lin. Canals. Brooks, ditches, and ponds everywhere.

C. caliculata, Drap. Small pond in Barkworth and Spaldin's yard Bristol road, near Gloucester. Millpond of Fisher's mill, Barton St. Mary.

Pisidium obtusale, Pfeiffer. What I believe to be this species, I took, in immense numbers, from a small shallow pond on the hill above Mitcheldean, in the direction of the Wilderness, of which it appeared to be the only molluscos inhabitant.

P. pusillum, Turton. Common. Canals, ponds, and streams.

P. pulchellum, Jenyns. Streams and canals. Clear ponds. Common.

P. amnicum, Müller. Common everywhere, with *Cyclus cornea*.

UNIONIDÆ.

Unio tumidus, Retzius. Severn, at Wainload, and all the canals. Common.

U. pictorum, Lin. Newent canal. Over. Berkeley canal, near Stonebench. Rare.

U. margaritiferus, Lin. Near Ross, in the Wye.

Anodonta cygnea, Lin. Common in the Severn and many smaller streams, and in all the canals of the district.

MYTILIDÆ.

Dreissena polymorpha, Pallas. Introduced by the opening of the Berkeley canal, in which, and in the other canals connected with it, and in the Severn, it is exceedingly abundant.

ESTUARINE SHELLS.

UNIVALVES.

LITTORINIDÆ.

Littorina littoralis, Lin. On the rocks near Purton Passage. Not common.

<i>Littorina rudis</i>	Donovan	} Sharpness Point, and Lydney piers.
var. <i>saxatilis</i> .	and <i>tenebrosa</i> .	

Common.

Rissoa ulvæ, Pennant. Brackish water ditches at Shirehampton, but more abundant on the opposite bank of the Avon, in the water-course running some distance parallel to it, from the direction of Pill towards Kingroad, where it may be taken in any quantity, with its well marked variety,

R. barleei.

BIVALVES.

TELLINIDÆ.

Tellina tenuis, Da Costa. Purton Passage.

T. solidula, Pulteney. „

Syndosmya alba, Wood. „

These three species may generally be sparingly met with, at low water, upon the silurian rocks, upon the edges of which the ferryman generally lands his passengers, and which are easily accessible to those who do not mind a *little* mud.

Notes on habits of Freshwater Shells, read at Dursley.

Neritina fluviatilis has been found, so far as I am concerned, of greater size and finer colours on the towing-path side of the canal, within hand-reach, near Sharpness Point, than anywhere else in the county; surpassing, in fact, in these respects those from Wainload or any locality in Britain known to me.

Testacella haliotoidea is generally supposed to be exceedingly limited in its distribution in England, and of doubtful nativity. It has been no stranger to me since I first began to collect mollusca, and was, many years since, particularly abundant in Wheeler's nursery, in the Northgate Street, Gloucester. So abundant is it now in many gardens in Gloucester, that in the early part of the present year, I was enabled,

upon Captain Guise expressing a wish for specimens, to send him two, almost by return of post.

Physa hypnorum. This very active creature—from the facility with which it ascends to the surface, returns to the bottom, or holds itself suspended in the tank-waters in which it may be confined, for the purpose of observing its habits—has given rise to the idea that it does so by means of threads. A very small exercise of the reflective powers on our parts, entirely setting aside observation of what really takes place, will suffice to demonstrate the fallacy of any such notion, for the following reasons :—

1stly. Because any *threads*, in a densely populated vivarium, would either constantly interfere with the free motions of any other creatures, or, from their fragility, with their subservience to the purpose for which they were intended.

2ndly. That their mucous consistency would be constantly diminishing, in the constant action upon them, of so solvent a fluid as water.

3rdly. That ordinary attention to the movements of the creature, will show that it can ascend at will from any part of the vase to the surface in the most direct line, and that it does so in the manner about to be described.

By bringing the edges of its foot closely together that member is converted into a tube, from which the column of water therein enclosed, is expelled with considerable force, either upwards or downwards, as the animal may be disposed to ascend or descend, being in fact a modification of the mode of locomotion adopted by the cuttle-fish, which effects its rapid movements by ejecting water through a funnel.

Physa fontinalis, and some of the other *Lymnæidæ*, exhibit the same powers, though in a less remarkable manner.

NOTES.

Dreissena polymorpha, when seen moored by its byssus, would lead us to suppose that any forcible detachment would be fatal, or attended by circumstances of extreme inconvenience ; but experience teaches us that it can detach itself at will from any position which has become disadvantageous to it, and take up any other more con-

genial. By means of its tiny foot, it will sometimes make the circuit of the vivarium, before it selects a resting-place, which may be, even then, but temporary. The species made its appearance in this district a few years after the opening of the Gloucester and Berkeley canal, and has increased in numbers to such an extent, that it may be said, without exaggeration, to line the canal banks, from the edge of the water, to a considerable depth, throughout its entire length of sixteen and a half miles. Upon the dock walls at Gloucester, it appears to occupy every available inch of space, from the water-line, to the depth of fifteen or sixteen feet.

Bulimus Lackhamensis has long been considered a local and comparatively rare species. I have reason to believe that it is neither, and that its apparent rarity, is merely a consequence of the creature's habits of life. I had frequently found the empty dead shell in many places upon the Cotteswolds, where I could not meet with living specimens, upon the most diligent search. In one of these, the most frequently visited locality, towards the end of August, I was astonished to find about a dozen upon the bole of a fine beech, near Birdlip, apparently descending the trees. Upon the majority of the surrounding beech trees I discovered great numbers, in similar positions. In the following month of March I found them again, in the same relative position, but in the course of the next month could find none, where they had been previously most abundant; whence, I infer that the apparent absence of the animal from its known habitats at certain seasons, is attributable to its habit of spending the summer months upon the trees, which it frequents at heights, which render it undistinguishable.

Limnæus putris, on the desiccation of the herbage, consequent upon the drying up of the rills whose banks it frequents, and which afford the degree of moisture requisite for its sustenance, will, in very hot weather, descend to the lower parts of the stems of the plants upon which it feeds, whence it appears to follow the receding waters at a certain distance. Should these entirely fail, and then become suddenly renewed, as, for example, by heavy rains or the opening of sluices, it immerses itself in them, and adopts for a length of time, proportioned to that of its deprivation of the fluid, the habits of *Lymnæus*.

The various kinds of *Lymnæus* are constantly seen floating on the surface of the water with the foot, in the fashion of a boat, and the shell downwards. They frequently do this, as may readily be seen, for the purpose of supplying themselves with air, but, if watched closely, it will be found that they have also another object in view, —they will be seen to collect upon the surface of the upturned foot,

the minute particles of which the thin film formed upon the surface of the water consists, whether of the drawing-room vivarium, or the exposed pond. After the lapse of some minutes, this being collected into a very minute but appreciable mass, is passed by a central furrow, to which a vibratory motion is imparted, upwards to the mouth, and swallowed with apparent relish. These animals are not purely phytophagous, but may frequently be seen hovering round the remains of dead sticklebacks and other small fish, with evidently more than mere regard for their *memories*.

The abbreviations used in the foregoing list, Lin. and Drap., refer to the works of Linnæus and Draparnand.



Notes on the High Crosses of Bristol and Gloucester.
By CHARLES POOLEY, Esq. of Weston-super-Mare.

BRISTOL HIGH CROSS.

A quaint old drawing, by ROBERT RICART, (a lay brother of the Fraternity of Calendars, afterwards Town-clerk in the reign of Edward IV.) which was designed to represent the town towards the conclusion of the Saxon era, favours the notion that "Aunciente Bristowe" was originally laid out in accordance with a plan embodying in its varied details some high truth of the Christian religion. Thus, it is said, the four principal streets, which reached from gate to gate of the city, formed a St. Andrew's Cross; the clusters of houses in each division a Maltese Cross; while in the centre, between four churches, and on the highest and most central part of the city, rose the *Alta Cruz*, the first object of the citizens' view, as that which it represented should have been of their hopes.* Whether old Bristow, the city of the Gap, was ever planned upon this idea of Christian Symbolism is a question at least doubtful; nevertheless, as a pretty poetical conceit, and one which, besides having the advantage of being eminently adapted to confirm the traditionally Christian character of the city, carries back the chronology of the Cross a thousand years, completing a historical unity, which few such structures in England can boast of, we avail ourselves of it as a befitting introduction to our paper.

The High Cross subsequently stood on the same site as the old Saxon Cross. The year 1373, memorable in the annals of Bristol, as an era from which many of its greatest improvements may be dated, is assigned as the period of its erection. Edward III. says Barrett,† having separated Bristol from the county of Gloucester, and constituted it a county within itself, and fixed its boundaries by

* The Calendars of All-Hallowen, Brystowe. By Revd. Henry Rogers, M.A.

† Barrett's History of Bristol.

an ample charter for that purpose, the citizens, to commemorate the event, and to show their gratitude and loyalty, rebuilt the removed Cross on the very spot where the old one stood, and embellished it in a most superb manner, placing the statue of King Edward III. together with those of two preceding royal benefactors, very well carved for the time, in the vacant niches of, perhaps, deposed saints.

King John was placed northward, fronting Broad Street. He gave the city the first and very extensive charter of privileges, especially all the void ground on the banks of the rivers, thereby to amend the town by building.

King Henry III. was fixed fronting Wine Street, eastward. He confirmed Henry 2nd's charter that established it a mayortown, and also that of King John, and joined Redcliffe to Bristol, making it one corporate town.

King Edward III. was fixed facing Corn Street, westward.

King Edward IV. was added afterwards to the other three figures, and placed to front High Street, southward.

Thus it stood, for at least 260 years, greatly admired for its antiquity and its ornaments. But in the year 1633, the city having continued to receive fresh and repeated instances of royal favour, and the Cross itself wanting some necessary repairs, it was taken down in part, enlarged, and raised higher in the same style of architecture, and the following four statues added :—

King Henry VI. who was placed in a new niche, eastward, He granted and confirmed all the charters of his predecessors.

Queen Elizabeth, who was placed westward. She also had confirmed the charters.

King Charles I. who was placed northward. He granted a new charter, and sold the castle and its dependencies to the city, which, to the great annoyance of the inhabitants, was before out of the mayor's jurisdiction.

King James I. who had renewed the charters, was placed southward.

Not content with these additions, the citizens caused the Cross to be painted and gilded, and enclosed with an iron pallisade, and surrounded by freestone steps, from whence all public proclamations were read to the people, and which served the market people to sit round when the market was kept in High Street. Its height from the ground was 39 feet 6 inches. In the year 1697, in such public estimation was this Cross held, that it was thought proper to have it fresh painted and gilded, which was done in such a costly manner, that no Cross in the kingdom is said to have exceeded it.

In the year 1733, however, it was doomed to a reverse. A silversmith who lived fronting it, out of enmity to this structure so esteemed by others, offered to swear before the magistrates that in every high wind his house and life were endangered, by the Cross shaking and threatening to fall (though it was not generally believed), and so requested its removal. On this pretence, and on the excuse of its obstructing the road, by filling up the street, it was taken down and thrown by in the Guildhall as a thing of no value, though its removal was generally regretted. For a long time it remained totally disregarded, until, by the interposition of Alderman Price and a few gentlemen, it was rescued from oblivion, and, with the approbation of the Dean and Chapter, erected in the centre of College Green, where it was viewed with pleasure by all, as a most curious piece of antiquity. But in time the Cross lost that reverence and regard that had been hitherto paid it throughout all ages, as in the year 1763 it was at length found out that this beautiful structure, by intersecting one of the walks, interrupted gentlemen and ladies from walking eight or ten abreast. One MR. CAMPION, a great projector, interested himself much in its removal, and solicited subscriptions of money, to be laid out in removing the Cross, and widening and rendering more commodious the walks in College Green.

The Dean and Chapter, on whose ground it was erected, gave leave for its removal; and many people who subscribed for widening and improving the walks, subscribed also for rebuilding the Cross in any unexceptionable place. But as it was thought no such place could be found in Bristol, the money was spent solely in laying out the walks. The Cross itself, rudely torn down and much injured by the workmen employed, was thrown by in a corner of the Cathedral, where, for a second time, it lay neglected, until DEAN BARTON gave it to SIR RICHARD COLT HOARE, of Stourton, who perceiving its value, and out of a love for antiquities, erected it in a most superb manner, at his elegant seat of Stourhead, at the expense of £300.*

It will be observed that the date of the erection of the Cross is referred to the year 1373. But in a M.S. Calendar allusion is made to the High Cross in so distinct a manner as to leave no doubt the same, or a similar structure, occupied the spot more than a century before. The passage runs thus:—"Anno 1247. Now that the bridges went happily forward, the townsmen on this side of Avon and those of Redcliffe were incorporated, and became one town, which before was two, and the two places of Markett brought to one, viz.—that at

* I am informed by Sir Henry Hoare that the Bristol High Cross was brought to Stourton in the month of August, 1766.—C. P.

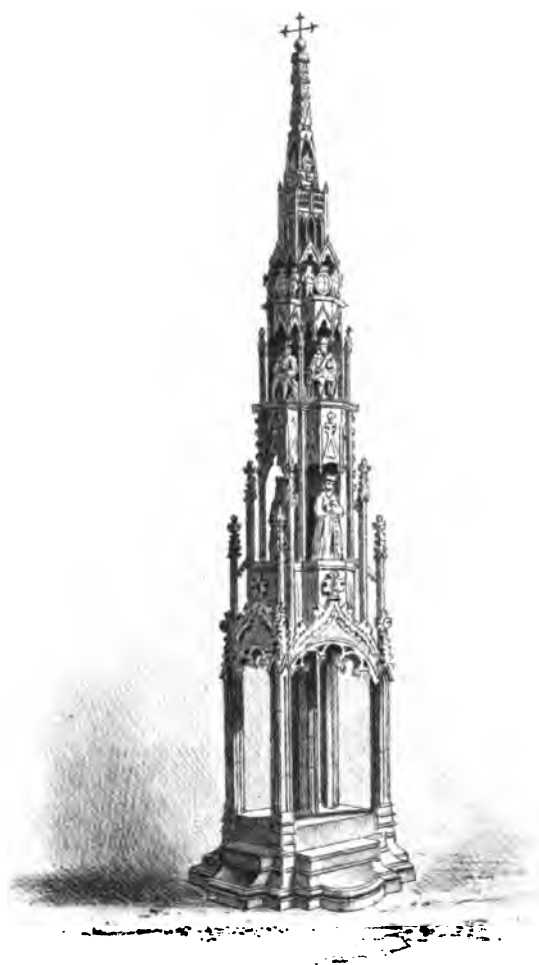
Redoliffe side being kept at Temple Cross, als St. Allege, or Stallege Cross; and also that from the old Markett, near Lawford's Gate; and both being made one, were kept where now it is, *and a faire Cross there built, viz. the High Cross, which is beautiful, with the statues of several of our Kings.*"* Other Calendars also allude to the same thing.

It is difficult to account for this discrepancy of dates, otherwise than by supposing that either the Calendars are not trustworthy records, (and the fact that the pen of Chatterton was known to touch some of them, makes their unqualified acceptance as historical documents anything but easy,) or else the rebuilding of the Cross in 1373 consisted in certain additions and embellishments, the rest of the High Cross, with the statues of the Kings, remaining as it was before. It must be remembered, however, that Barrett expressly states, that the erection of the Cross of 1373 was only the "rebuilding the removed Cross on the very spot where the old one stood," implying clearly the existence of a High Cross before that time, and on the same site.

The plate of Bristol High Cross is taken from a scarce old engraving in my possession, and represents the Cross as it appeared after its restoration in 1633, at which time the upper stage of statues, and the tier above, and the curious nondescript pinnacle, were added.

In a valuable paper read before the Bristol and West of England Architectural Society, in 1849, by JOHN NORTON, Esq. the architect of the Cross now standing on College Green, it appears that the material used in the construction of the old Cross was a coarse-grained oolite, the ova being large and distinct, and hence liable to absorb moisture, and become injured by frost. This fault was remedied for many centuries by the application of polychromatic colouring, which evidently formed an effectual preservative against the weather. In its present mutilated state, the Cross affords sufficient proof that originally, not the figures only, but the entire surface of the stone work was thus enriched, the figures having best preserved these remains of colouring. The colours used were vermilion, blue, and gold. The gilding may be traced in every part,—on the ribs of the groining, &c. but the vermilion being the most durable, has retained its rich hue, while the blue has faded to pale grey. The dresses of the figures were for the most part painted vermilion; the mantles, and such portions of dress, blue; the borders, and other subsidiary ornamental parts, being relieved with gold. But this surface of painting has long fallen into

* *Memoirs Historical and Topographical of Bristol.* By the Rev. Samuel Sayers, M.A.



From a Stone Print

Laws, Rich Bristol

BRISTOL HIGH CROSS

decay, and hangs in loose flakes. Generally, one of the above-named colours may be seen in an intermediate coat or stratum. In consequence of the lower stage of the building having been filled in with solid ashlar masonry on its removal to Stourhead, for the purpose of support, the size of the original central column is uncertain. The present appearance, however, assures us that the effect would be enhanced, by its being made as light as is consistent with safe construction, bearing in mind that the superincumbent weight is very considerable.

The form of the arch in this stage is flat, being segmental, and nearly approaching to a four-centred arch. The ogee-arch being high, a large spandrel space is thus left for foliation. The crockets and finial are unusually large, and very boldly carved; the character of the trefoil open panelling of the lower pedestals is late, and the whole detail and design is quite late Decorated, almost approaching early Perpendicular. The present outline is very elegant, and there is no reason to doubt its being very near its original form and height; for the upper portion being the lightest, may have become first decayed, and thus account for its present debased and heterodox character. Some traces of a later taste are likewise discoverable in the lower stages, some of the cusp terminations resembling Italian Cherubs' heads.

From the foregoing Notes we collect the following historical summary of events relating to the Cross:—

- 1.—The old Saxon Cross, erected *Circa* A. D. 950.
- 2.—The High Cross, which succeeded it, to which reference has been made in the Calendar, erected A. D. 1247.
- 3.—The High Cross, described by BARRETT, erected A. D. 1373. The Cross is marked in Hæfnagle's Map, *Circa* A. D. 1575.
- 4.—The same Cross, embellished, and raised higher, and other statues added, A. D. 1633. Reign of Charles I.
- 5.—The same Cross, fresh painted and gilded, A. D. 1697.
- 6.—The Cross taken down, A. D. 1733, and
- 7.—Re-erected in College Green.
- 8.—Taken down again, A. D. 1763.
- 9.—Removed to Stourhead, A. D. 1766.

Having thus traced the history of the High Cross from the earliest period in which any allusion is made to its existence, through all its vicissitudes, to the time when it found sanctuary at Stourhead, we cannot more fitly conclude the subject than by a brief notice of, what may with propriety be designated, the **NEW CROSS**, **NOVA CRUX**, now standing on College Green, a not unworthy successor to the old Cross, and a monument to the good feeling which prompted the citizens of

Bristol to redeem their error of thoughtlessly allowing the older structure to be alienated from them.

The Cross is, in fact, a part restoration of the original design. It was erected after the plans of JOHN NORTON, Esq. at a cost of £450, A. D. 1851. As, however, it differs from the former in some essential particulars, we cannot do better than quote the architect's description of it. "While," he says, "the old Cross exhibits throughout marks of debased and discordant additions, in the new one an attempt has been made, not only to preserve the beautiful outline, but to embody one uniformly harmonious feeling throughout, being that of the period of its earliest foundation. For example:—Above the sitting figures, in the Old Cross, is a tier or frieze of boys bearing shields, of the taste of Charles's reign. This looks crowded and excrescence-like, and by its "bustle" mars the grace of the outline; and, therefore, this feature has been discarded, and the pyramidal lines made at once to spring from the upper canopies.

"The modern Cross is divided into four separate stages. The lower, composed of the open groined space, is square in plan, the groining ribs dying on to a central octagonal column, which they connect with the four angular buttresses, and also immediately support the lower pedestals, through whose mullioned spaces the play of light produces a good effect: a kind of rough groining shaft attaches the open work to the central construction.

"The second tier is composed of the niches and projecting canopies, under which four life-size figures may stand.

"The third tier has the same features for four sitting figures, and the fourth is the pyramidal covering or spire, completing the outline suggested by the buttresses. As a piece of mediæval construction it affords a valuable lesson, worthy of careful study. The mode by which the enormous weight of the canopies, &c. is conveyed laterally on to the ground, by means of flying buttresses, attaching the under to the inner vertical buttresses, cannot be too much admired. Surely here the great canon of architectural construction has been well attended to, namely, that of *ornamenting construction*—for it is by these buttresses that the beautiful outline is produced."

Chaste and elegant as this building undoubtedly is, developing in its fine proportions an architectural beauty, which was in vain to be sought for in the spurious taste with which successive ages adorned the former edifice, it is nevertheless to be regretted that the High Cross, so rich in its evidences of antiquity, and consecrated by so many venerated associations, should have passed into other hands. To the citizens of Bristol it was a heritage handed down to them, as we have



From an old Engraving by Vertue

Lavers, Ltd. Bristol

GLOUCESTER HIGH CROSS.

seen, from a very remote period, when indeed it was regarded as a symbol, emblematic of Him who hung thereon, and so placed in the highest and most central part of their city, that they might ever have before their eyes the lesson it inculcated, that to Him alone should be directed all their highest aspirations, even in the conduct of their worldly affairs; while, at a later date, it became "a sort of historic pillar, bearing record to the gradual advancement of the City of Bristol in times when the interests of commerce and the progress of civilization were dependent on the personal favour of princes."

GLOUCESTER HIGH CROSS.

Very little appears to be known concerning this fine old Cross. It stood near the Tolsey, and, like Bristol High Cross, occupied the centre of the space formed by the intersection of the four principal streets. The date of its erection is conjectural. The plate is taken from an engraving in the *Vetusta Monumenta*, and the writer, in describing it, is of opinion, that it was as ancient, at least, as the time of Richard III. Fosbrook, also, considers the towers and vanes with which the top of the Cross was decorated as a certain mark of the architecture of the 15th century. Its height was $84\frac{1}{2}$ feet. It was octagonal in form, and consisted of two tiers or stages, with an embattled top decorated with towers and vanes, from which sprung a diminishing eight-sided shaft, in three parts, the lower loop-holed, the two upper slightly ornamented, supporting a globe and cross. The style of the whole of this part is bastard, and has no affinity with that of the two lower tiers. It is not improbable that a crocketed spire formerly surmounted the second tier, which would have been in keeping with the rest of the architecture. An embattled moulding ran round the base of the second stage. In the basement, the arches were closed by masonry, but the stage above was divided into eight niches, uncanopied, in which the following statues of Kings and Queens were placed, and for the accompanying reasons:—

King John, because he was Earl of Gloucester, and afterwards, when he was King, made it a borough-town.

King Henry III. because he was crowned here, and by the grant of a charter, made it a corporation.

Eleanor his Queen, because she founded St. Bartholomew's Hospital.

King Edward III. because of his great renown, and success against France.

King Richard II. because he resided some time in this city, and held a parliament therein.

King Richard III. because he was Duke of Gloucester, and when he became King, annexed the two hundreds of Dudston and Kings Barton to the jurisdiction of the corporation.

Queen Elizabeth, because she established the Protestant Religion.

King Charles I. to show the detestation of the citizens, of the former disloyalty acted in this place;*—a piece of unworthy adulation on the part of the Mayor and Corporation who sanctioned it.

It has been suggested, that the circumstance of the statue of Richard III. having been one of the eight, confirms the opinion that the Cross was erected during this King's reign, as it is scarcely probable it should have been placed there after his death, under the reign of the Tudors. The statues of Queen Elizabeth (a Tudor) and King Charles I. (a Stewart) were erected there, it is naïvely remarked, "for particular reasons."†

In the year 1749, an Act of Parliament having passed for taking down several buildings, and enlarging the streets and market-places in the city of Gloucester, it was deemed necessary, in order to carry out its provisions, to remove the High Cross. This was done accordingly; but what became of it after its demolition, all researches to discover have been in vain. Probably its fragments were dispersed to be used for building purposes elsewhere—a fate not uncommon to ancient Crosses.

* Sir Robt. Atkyns' History of Gloucestershire.

† Vet. Mon.

On Gryphæa Incurva and its Varieties.

BY JOHN JONES.

Few fossil shells are better known to Geologists, or to the populace of the districts in which they occur, than those which form the subject of the present paper. The abundance in which they are found in the Vale of Gloucester, in the classical sections of the Lias, as at Purton and Fretherne, and in the superficial soils as exposed by agricultural operations, renders them familiar to all, and accounts for their having received popular names. The generic denomination, in scientific language, is derived from the Greek word ΓΡΥΨ or ΓΡΥΨΙΟΣ, "incurved or inflected," which well describes the most striking characteristic of the commonest form—the *Gryphæa incurva*. The popular names, "Devil's toe-nails" and "Cuckoo shells," are of more obscure origin. The ordinary specimens of *G. incurva*, when viewed in profile with the concave valve almost concealed from view, readily enough suggest the idea of talons, and in the absence of any other monster sufficiently formidable to bear them, known to the unlearned, are naturally considered to be "membra disjecta" of the father of evil himself. The larger and more strongly incurved specimens, may in like manner, suggest to some imaginations the idea of horns, which appendages are supposed to be worn by members of a secret society, to whom the note of the bird of Spring is held to be particularly obnoxious, accounting therefore for the connection of its name with the shell in question. They were formerly calcined to make a lime water, which was considered a sovereign remedy for a malady to which cattle are subject, called the red-water. It would have been difficult to select a group of shells which could better exemplify the utility of such a series of illustrated monographs, as that to which the Club proposes to devote its resources, as will be shown in the present paper, which will treat only of the Gryphites of the Lias.

In adopting the name *Gryphæa*, we do not lose sight of the fact, that in all probability, the inhabitants of the shells to which it is restricted were true oysters; but there is connected with it, so well defined an idea of an oyster of peculiar type, which first makes its appearance in the Liassic formation, that the convenience of its retention is obvious, and the question whether it should take generic or sub-generic rank, is of trifling importance. This group of shells consists of those which, from regularity of form, uniformity of character, and presumed difference of habit, were separated from the oysters under the name of *Gryphæa*, by LAMARCK, in his "*Système des Animaux sans Vertèbres*," in 1801, but as he was apparently misled, by having studied the adult shell only, and conceiving that it had always been free, therefore gave in his generic definition undue prominence to this assumed fact, we adopt the following description of SOWERBY, from his *Mineral Conchology*, as generally, though not absolutely, more concise and correct.

GRYPHÆA.

"A free, (except when very young,) unequal-valved, inequilateral "bivalve, larger valve involutely curved, concave, smaller valve flattish, "beakless; hinge, a transversely striated pit, containing an internal "ligament, without teeth or crenatures."

The Liassic species, recognised by most English writers, to which the foregoing generic terms apply, are those to which we have now to address ourselves, and may be stated as follows:—

Gryphæa incurva, Sowerby.

G. suilla, Schlotheim.

G. obliquata, Sowerby.

G. Maccullochii, Sowerby.

G. depressa, Phillips.

G. cymbium, Lamarck.

all of which, labelled as above, are to be found in most collections of importance throughout the kingdom, and are more or less common (as we believe) in this district.

Upon enquiring where, as tyros, we may find pictorial illustrations of the differences between them, we learn that we must refer to the works cited as follows:—

For *G. cymbium*, to the *Encyclopédie Méthodique*; the *Petrefacta Germaniæ* of Goldfuss; the *Coquilles Fossiles des Environs de Paris*, of Deshayes; Sowerby's *Mineral Conchology*; or Phillips' *Geology of Yorkshire*.

For *G. depressa*, to the last-named work.

For *G. incurva*, to two of the former works; to the Petrefacten of Zieten; and Parkinson's Organic Remains.

For *G. suilla*, to Goldfuss.

For *G. obliquata* and *Maccullochii*, to Sowerby's Mineral Conchology.

It is scarcely necessary to observe, that all these works are of so expensive a character, as to place them beyond the reach of the great majority of geological students; that they are all out of print, and not always attainable by those who *can* afford to purchase them; hence, therefore, the desirability of carrying out the design we have formed. It will be seen in the sequel, that we shall have occasion to refer to various other supposed species, described by continental authorities.

The first which claims our notice in stratigraphically ascending order is the *Gryphæa incurva*, of Sowerby, or *arcuata*, of Foreign Writers, the latter being the name under which it was described by LAMARCK, the typical form of which has been figured by the following, amongst many other authors:—

Bourget, 1742, *Traité des Petrefactions*, Paris. Plate 15, figure 92.

Walcot, 1779, *Description of Petrifications near Bath*. P. 51, f. 34. *Encyclopédie*, 1789. P. 189.

G. arcuata, Lamarck, 1801, *Système des Animaux sans Vertèbres*. P. 398.

G. arcuata, Parkinson, 1811, *Organic Remains*. Vol. III. p. 209, P. 59, f. 4.

G. incurva, Sowerby, 1815, *Mineral Conchology*. Vol. II. p. 23, P. 112, f. 1, 2.

G. arcuata, Lamarck, 1819, *Animaux sans Vertèbres*. Vol. VI. P. 198, No. 4.

G. incurva, DeFrance, 1829, *Dictionnaire des Sciences Naturelles*. XIX. P. 536.

G. arcuata, De Blainville, 1825, *Manuel de Malacologie et de Conchyliologie*. P. 59, f. 4.

G. incurva, Zieten, 1830, *Die Versteinerungen Wurtemberges*. P. 65, pl. 49, f. 1.

G. arcuata, Deshayes, 1831, *Descriptions des Coquilles Caractéristiques des Terrains*. P. 98, pl. 12, f. 4, 6.

G. arcuata, Goldfuss, 1835, *Petrefacta Germaniæ*. Pl. 8, f. 1, 2.

G. arcuata, Roemer, 1836, *Die Versteinerungen des Nord Deutche: Oolithengebirges*, Hanover. P. 62.

G. arcuata, Schmidt, 1846, *Petrefacten-Buch*. P. 61, pl. 18, f. 3.

Ostrea arcuata, Deshayes, 1849, *Traité Elementaire de Conchyliologie*. Pl. 56, f. 8, 9.

Ostrea arcuata, D'Orbigny, 1850, *Prodrome de Paléontologie Stratigraphique*. Vol. I, p. 220.

It is, in fact, the shell invariably figured as the best type of the subgenus to which it belongs, and cannot fail to be recognised from the rudest figure, or from the following description, which is here somewhat amplified from SOWERBY.

SPECIFIC CHARACTER.

"Elongated, very involuted, right side" presenting a more or less "strongly marked, or an obscure lobe," (when viewed with the smaller valve placed downwards, and the umbonal portion turned away from and at right angles to the front of the observer;) "lesser valve oblong," "externally concave."

This description applies only to the ordinary adult form, than which none would appear at first sight to be more easily determinable, but the following list of what are considered by some authors of repute to be distinct species, and merely synonymes of one, by others, will at once give an idea of the notable modifications and changes of form, of which this species is susceptible, the shells named in it representing every imaginable gradation between the outlines of the Common Oyster, and those of the most perfectly developed *G. arcuata*.

<i>G. Maccullochii</i> of Zieten.	...	...	Table 49, fig. 3.
<i>G. læviuscula</i>	"	...	" " " 4.
<i>G. ovalis</i>	"	...	" " " 1.
<i>G. Maccullochii</i> of Sowerby.	...	...	" 547, " 1, 2, 3.
<i>G. gigantea</i>	"	...	" 391.
<i>G. obliquata</i> , Goldfuss.	...	...	" 85, " 2.
<i>G. obliquata</i> of Sowerby.	...	...	" 112, " 3.
<i>O. irregularis</i> , Goldfuss.	...	...	" 79, " 5.
<i>O. læviuscula</i> ,	"	...	" " " "
<i>O. ungula</i> , Münster, Handbuch, jeune.	"	...	" 325.
<i>O. semicircularis</i> , Roemer.			
<i>O. irregularis</i> , D'Orbigny, 1853.			Prod. VI. p. 238.
<i>O. intermedia</i> , Terquem.			
<i>G. depressa</i> , Phillips.			
<i>G. lobata</i> , Buvignier.			

Although Oysters have been found in much older formations, as exemplified by the unique specimen of *Ostrea nobilis*, from the carboniferous limestone of Belgium, which may be seen in the British Museum, with others from the Triassic "Saliferian" of St. Cassian,

they amount in number of species, in the opinion of our talented colleague, MR. S. P. WOODWARD, to three only, and it is first in Jurassic strata, that they make their appearance in any remarkable number or variety.

Taking into consideration this fact, with that of the universally admitted variety of forms attributable to one species: to those who have interested themselves in the theory of transmutation, as originally propounded by LAMARCK, subsequently by the Author of the Vestiges, and since, more practically by DARWIN, in his Treatise on the Origin of Species, the elaboration of figures, and the minute details here presented, although apparently uselessly repeated, may yet assume an aspect of interest which they could not otherwise possess. *Ostrea Interstriata* (*Plicatula*, of Emmerich,) of the White Lias, and the small oyster, which covers the slabs of Lower Lias at Wainload, Westbury, Penarth, &c. associated with *Modiola minima*, recognized by BUCKMAN and other local writers, as *Ostrea Liassica*, are the earliest known to us in this district. Distinctly Gryphoid forms occur considerably higher in the series, and are most abundant from the zone of *Ammonites Bucklandi*, to that in which it is supposed to be replaced by *Gryphæa obliqua*; but any one who has carefully examined these in considerable numbers, and can therefore fully appreciate the infinite diversity of form which they assume, rendering the determination of the differences between Oysters and Gryphites exceedingly perplexing, may possibly, in the sequel, feel disposed to adopt the suggestion of QUENSTEDT, that *Ostrea Liassica* may really be the ancestral precursor of the species under consideration. As the true relations of these forms can only be properly illustrated by examples, we must now refer to figures of the specimens selected for that purpose.

Figures 1, 1^a, 1^b, Plate 1, represent specimens of ordinary type from Purton, near Sharpness Point.

Figures 2, 2^a, 2^b, Plate 1, are half grown, and 3, 4, 4^a, more advanced forms, in neither of which is the beak obliquely incurved, but is very nearly central,—the lateral lobe is scarcely traceable in either of these specimens, while it will be observed that the smaller valves differ much in character. On comparing figures 2 and 4 with fig. 3, that of 3 is seen to be exceedingly massive, composed also of very thick plates, and rising prominently above the margin of the lower shell, whilst those of figures 2^b and 4^a, being formed of thin laminæ, are concave, and, as seen in profile, with scarcely any portion of them visible above the margin of the lower valves. All these are from the *Ammonites Bucklandi* bed at Purton, where they occur in immense numbers, and in the best possible state of

preservation, both in the limestone layers and in the clays. Figures 3 and 4 may appear of greater width than usual in proportion to their length, but if studied in the inexhaustible series always to be found in the locality indicated, the observer may speedily convince himself, that every conceivable form intermediate to these, exists there, and that these extreme forms, as well as others hereafter to be described, are not only united, but virtually inseparable. Figures 1, 1^a, 1^b, and 2, Plate 2, are taken from two specimens of *MR. W. C. LUCY*'s collection, from the *Pentacrinites tuberculatus* zone, at *Fretherne*. The side furrow upon these is remarkably distinct, and may be traced to the extreme apex of the beak, giving rise to a corresponding ridge in the smaller valve. This peculiarity, which instantly forces itself upon the attention of the observer, who has previously visited *Purton Cliff*, as it seldom or never presents itself in specimens from that locality, has doubtless its physiological value. The smaller specimen, Fig. 2, Plate 2, exhibits most of the characters of *Gryphæa obliqua*, but placed in juxta-position with the larger, the possibility of its being other than a less advanced stage of the same species, cannot for a moment be entertained. These with Figures 1, 1^a, 1^b, Plate 5, and Figures 3 and 4, Plate 4, represent full grown individuals, than which very few attain to greater size; and it is noticeable, that the patriarchal giants of their race, presenting the most distinctive characters of *G. incurva*, are not found where examples are most readily procurable, and in the largest number, but in higher stages than the *A. Bucklandi* or *P. Tuberculatus* zones, particularly in the lower portion of the yellowish grey clays, which lie between the zone of *Ammonites obtusus*, and that of *Ammonites oxynotus*. Exceedingly good specimens have been obtained from excavations in *Gloucester*, which have been placed at our disposal by the kindness of *MR. HENRY ARKELL*; they are also frequently obtained from farm drain-cuttings in the neighbourhood.

Figures 3, 3^a, 3^b, and 4, 4^a, 4^b, Plate 2, represent specimens of the dwarfed variety, which occurs in the upper portion of the yellowish grey clays above alluded to, where they assume a somewhat marly character, as seen exposed on the estate of *T. B. LL. BAKER, Esq.* at *Hardwicke*, in this county, on the surface of a piece of land called *Southfield*, not far from the canal bank, on the left hand descending from *Gloucester*, crossing the sixth bridge. Several specimens were found in a small depression in the soil, which will readily be seen upon entering the field. These dwarfs are placed in comparison with the form last figured, not for the sake of contrast, but in natural ascending order, as its successor and legitimate representative, presenting all its essential characters, exhibiting all its marks of perfect development

and old age, being overgrown by the same parasites,* which, like them, have succumbed to the changes of the conditions of existence common to all of them, and differ from *their* predecessors, only in diminished proportions. Both the assumed adult forms before referred to, *G. incurva* and *obliqua*, occur sparingly in the *A. oxynotus* beds, whilst the young form here exhibited, Figures 2, 3, and 4, Plate 3, is very common, and is doubtless that, which at a more advanced age, has received the name of *G. suilla*, to which we shall have occasion hereafter to more particularly refer.

The next four specimens produced are from beds still higher in the series, in the group which probably represents the *Ammonites raricostatus* zone of Oppel, well exposed in "Skirts' cutting" on the Oxford, Worcester, and Wolverhampton Railway. Fig. 2, 2^a, 2^b, Plate 4, is from "Skirts' cutting," where it occurs with *Ammonites planicostatus* and *Hippopodium*. Figure 3, Plate 4, is from the *Hippopodium* bed, described by MR. GAVY in the Quarterly Journal of the Geological Society, associated with *Ammonites raricostatus*.

Figure 2 being evidently a half-grown form closely resembling the variety Figures 1, 1^a, 1^b, Plate 4, intermediate to *G. Maccullochii* and *cymbium* last figured, it is worthy of notice that while Figure 3, Plate 4, approaches very nearly in outline to GOLDRUSS's figure of *G. cymbium*, Plate 85, Figure 1, Fig. 4, Plate 4, re-assures us that we have still before us *Gryphæa incurva*. It has become more elongated in proportion to its width, but preserves every other character; while Figs. 2 and 3, making allowance for dissimilarity of age, differ from it only in having lost almost every trace of the lateral furrow. Closely associated with these forms, differing only in the same degree as *Gryphæa*, Var. *striata* of Goldfuss, from *Gryphæa incurva rugosa*, is the specimen represented by Figures 2, 2^a, 2^b, Plate 5, which still more nearly approximates to *Gryphæa cymbium*, before mentioned. This specimen, which is the only one we have seen from the stratum in which it was found, is from the zone of *Ammonites Henleyi*, and may be considered to be the last appearance of what we believe to be any variety of *G. incurva* in the lower lias, unless Figures 3, 3^a, 3^b, Plate 5, from a specimen lent us by the Council of the Worcester Naturalists' Society, deposited in its Museum by MR. GAVY, without naming the locality from which it was derived, should prove to be, as is probable, from the *Ammonites Ibex* beds of Mickleton, which would bring us almost to the base of the middle lias. These specimens agree perfectly with those figured

* *Anomis* and *Serpula*.

by GOLDFUSS, as *G. Maccullochii*; but for ourselves, after carefully comparing a great number of similar forms from other beds, and the figures given by GOLDFUSS, SOWERBY, and TERQUEM, we can discover only such differences of degree, and not of kind, as have induced us to consider all the forms hitherto presented to be mere varieties of *Gryphæa incurva*. SOWERBY's figure of the Shell upon which he based his species of *Gryphæa Obliquata*, corresponds in general character with our own figures 5, 5^a, 5^b, Plate 3, taken from specimens of the same type; but we must remark that his drawing is as incorrect, as the specimen itself from which it was made must have been imperfect, lines of the ligamental fossa being continued in the engraving over the apex of the shell, from which the lines of growth commence!

Figures 6, 6^a, 6^b, 7, 7^a, 7^b, Plate 3, Figures 1, 1^a, 1^b, 2, 2^a, 2^b, Plate 4, represent forms intermediate to the last, to the various forms called *G. cymbium*, by GOLDFUSS, and to *G. Maccullochii*, of other Authors, found in various beds ranging from that of *Ammonites Bucklandi*, at Purton, to those exposed in the brickyard at Honeybourne Station; these, and the specimens exhibited in conjunction with them, agree perfectly with many published figures to which the distinctive appellations quoted have been assigned; but with the series at our disposal before us, it is impossible to separate them, even as well marked varieties, from *Gryphæa incurva*.

We will now take into consideration, the actual vertical range of this species, which extends we believe nearly to the base of the Liassic formation, and much lower than the beds in which it first becomes known to us by the name, which we have hitherto applied to its commonest form. This question we shall be better able to discuss after the examination of other forms, which occur within the same or neighbouring limits. Upon close inspection, almost every specimen of *Gryphæa*, will show that it has been in its earliest stage, attached by the flattened or scarcely rounded extremity of the beak, to a foreign body, and it is noticeable that the symmetrical development of the adult, appears to have mainly depended upon the period at which it became free, the comparative duration of which, in various individuals, being indicated by the extent of area so rounded or flattened. Most of those hitherto exhibited and figured, must have freed themselves comparatively early, as in none of them is the once attached surface, sufficiently large to break considerably the regular curve of its outline, whilst in some of them, it is so obscure as to be traced with difficulty. Upon transferring to paper the outlines of that portion of the shell only, which could have existed at the time of its assuming its liberty, which

is easily done by tracing, in well cleaned examples, those lines of growth of which the edges converge at the point, where the profile curve of the external portion of the true apex commences, and from which the lines of the ligamental fossa recede, it will be clearly seen that it must once have so closely resembled the young of an oyster, as to render it difficult to distinguish the one from the other. Having now arrived at the conclusion that the young Gryphite must, for a period, more or less uncertain, resemble an oyster, it becomes interesting to ascertain how long such resemblance might endure, and to what extent it could proceed. In figures 5 and 5^a, Plate 2, we represent the upper surface and profile of a shell which is attached to a Gryphite by a base so large, furnished with an upper valve so rugose and convex, with ridges following, and corresponding with, the inequalities of the shell upon which it grew, exhibiting very obscure and irregular concentric lines of growth, and an appearance so completely that of an Oyster, and different to that of a Gryphite, that no one, who had never seen similar specimens, in a series of still further advanced stages, could admit its relationship in any degree to the latter: notwithstanding which, proof most complete to the contrary can be produced, by figures 6, 6^a, 6^b, Plate 2, representing the profile, upper, and lower surfaces of a shell of this description, which have become free at a more advanced age; whilst figures 1 and 1^a, Plate 3, show another, which, apparently unable to acquire its liberty, is developed, while still attached, into an indubitable Gryphite.

If we carefully examine the detached shell we may learn from it not only a portion of its own history, but so much of that of its neighbours, as will enable us to account for many of the peculiarities of these abnormal individuals. A reference to figure 4, Plate 4, will show, upon a little reflection, that in a shell of typical form, growing in the ordinary manner, its inhabitant enlarged the habitable space, by adding foliations to the front and sides of its shell, depositing at the same time, in the space nearest to the beak, which had become inconveniently contracted for its accommodation, could not be enlarged, and from which the animal's instinct led it to retire, a corresponding amount of shelly matter, and bringing forwards the proportionately expanding ligament, into its ever widening furrow, after itself. This furrow or pit is seen in figure 4, Plate 4, above referred to, and the shell itself well shows why the incurved portion of the beak, must have continued to increase in thickness and weight during the life of its tenant, whilst the opposite extremity of the chamber became thinner and weaker. It is apparent that the animal could not, under any circumstances, extend the space required for its habitation in a backward direction,

and it is equally clear that had it, while attached, extended it forwards in the manner which it adopts when free, and to the same degree in the same time, it must have recurved upon itself, until its further growth would have been arrested, and respiration impossible. Granting, therefore, that this be true, it follows that the animal possessed an intuitive perception of the exigencies of its position, and, to a certain extent, the power of accommodating itself to them.

We see, for instance, in the examples before us, that, unable to provide that normal degree of concavity which is proper to the larger valves, the creatures compensated themselves for the circumscription, by giving an unusual convexity to the smaller valve, a corresponding degree of lateral expansion to the larger, and retaining throughout the period of their existence, those modifications of form which were rightly special only to a portion of it.*

Here naturally arises the question, whether the young animal could of its own volition free itself from connection with the body to which it had attached itself, and this we think may be answered affirmatively, from the fact, that, in the majority of instances, that connection could have endured but for a short time. The primary point of adhesion must in general have been so small in the young fry, and applied to surfaces so even, that a very slight exertion of force of any kind, either voluntary or involuntary, would have sufficed to detach it; but we can readily conceive that in the event of adhesion taking place to uneven surfaces, as shown in figures 5 and 6, Plate 2, and fig. 1, Plate 3, where rugosities of the kind suggested exist in every part of the valves of each, the union between the two bodies, must have become so complex as to render separation impossible, except by the application of very considerable force.

In the event of contact remaining unnaturally prolonged, as in the case of *Ostrea læviuscula* and *irregularis* of Munster, the foregoing observations would in all cases properly apply.

Quenstedt's figures of *Ostrea irregularis* and *rugata* (Der Jura, table 3, figure 15, a, b, and f. 18, and those of Chapuis and Dewalque)† are so evidently taken from imperfect individuals of this species, that more than a reference to them is unnecessary, Quenstedt's figure 16 resembling so closely our figure 5, Plate 2, as to appear, upon a cursory view, to have been copied from the same specimen. The shells usually labelled as *G. suilla*, appear to be selected from the small flat-looking examples before referred to as occurring abundantly in certain localities with

* Compare relative length and breadth of Figure 1 and Figure 4, Plate iv.

† Description des Fossiles des Terrains Secondaires de la Province de Luxembourg.

Ammonites oxynotus, figures 2, 3, and 4, Plate 3, and which are nothing more than the young of *Gryphæa incurva*, probably var. *obliqua*. We have obtained large series of these at the brick-pits near Lanthony Priory, Gloucester, and upon the canal banks between Lanthony Bridge and the second mile post, the adult form being comparatively rare in the stratum. The shells figured as *G. suilla* by Goldfuss, are also immature forms, no longer considered by most Palæontologists to be other than varieties of *G. incurva*, although they seem to occur in such vast numbers, not advanced beyond this stage of growth, in particular strata, as to form their characteristic shells. Quenstedt, treating of the Malmstein of his Lias Alpha, says significantly, with regard to the resemblances of this shell to others, "Here, in the space between the worked stone, we meet for the first time with distinct Gryphites which are very nearly allied to *arcuata*, nevertheless, it is true, not yet with their doubled, crooked, incurved beak upon them. Their precise determination is also rendered difficult, on account of their appearing for the most part as Casts. I doubt not that *G. arcuata* proceeds from these, although they are smaller and flatter." "Hehl allows them to continue under Zieten's name of *G. ovalis*; others call them *G. suillus* of Schlotheim, because those from the Haimberge, near Göttingen, are somewhat broader. *G. obliquata* of Sowerby also, T. 112, f. 3, often agrees very well with them. We cannot arrive at a firm foundation with all such form-comparisons, since they again differ amongst themselves in an extraordinary degree. Here stratigraphical position must assist us, or we proceed entirely in error." (Page 54, *Der Jura*.) "He refers to *Ostrea rugata*, which occurs with *Ammonites angulatus*, little wrinkled casts with crooked, strongly incurved beaks, but which belong rather to the group of *O. rugata*," described by him in the same work, at page 60. Zieten's figure of *G. ovalis* is here useful for comparison, and Quenstedt, at page 46, suggests the same between it and his *O. rugata*, a more thin and delicate shell, which appears at a still earlier period. His *O. irregularis* and *O. rugata* are both referred to his *Ammonites pailinotus* beds,—our *Am. planorbis* beds—the first, described as a small, but frequently recurring oyster attached to *Plagiotoma* and *Monotis* (avicula,) *inæquivalvis*, and growing upon them, but upon separation quickly assuming the manner of growth of the Gryphites: the second as occurring at "Hüttlingen, between the Malmstein and the *G. Arcuata* beds, forming a thick bank, entirely filled with its thin wrinkled shells," which forcibly call to mind *G. arcuata*, although the strata of the *Arietenkalk*," (our *A. Bucklandi* beds) "are those in which this fully developed shell first appears." He nevertheless maintains that it is traceable even lower than the Malmstein beds, we presume, in the form

before mentioned. We may incidentally mention here, that in his description of *G. incurva*, he says it ought to be named *G. rugosus*, as having been first figured under that denomination in the last century, by Lang, in his *Historia Lapidum, &c.* T. 48, f. 1 and 2. He attributes all such modifications of this form as *G. obliqua*, and *Maccullochii* to this species; the most remarkable of these to difference of age; and consequently to the greater or less expansion of base, at the time of the larger valve acquiring its freedom: in illustration of this he gives a figure, T. 9, f. 9, (which is an exaggeration of our own Figure 6, Plate 2,) with the following observations:—"Assuch causes producesimilar results in all the Jurassic Gryphites, I do not think these last should be considered oysters, although they bring to mind *O. irregularis*, before mentioned. (Page 48, Jura.) What is most remarkable is only this, that the axes of upper valves, not truncated, but, exogyreiform, are turned outwards. How easy for such abnormalisms to become hereditary, and so, apparently to degenerate into another species."

OPPEL, in his "*Mittlere Lias Schwabens*," under his *Ostrea Amalthei*, makes the following remarks, on separating these shells into distinct species:—"Goldfuss figures, an *O. irregularis*, from the lias marl, of Linz, and we have similar examples in our lower Numismalis-marl, with *G. cymbium* and *G. obliqua*. In Table 4 and 8 I have figured such a one, to which is attached *Ostrea cymbium*; nevertheless, this oyster passes completely into *Gryphæa*, when its point of attachment becomes somewhat smaller, and changes with its growth from *G. cymbium* to *G. obliqua*, and the latter to *O. irregularis*; so that when many examples are placed together I am not able to define the distinct limits between *O. irregularis* and *G. cymbium*. As we have similar variations of form between *G. arcuata* and *G. calceola*, so are *O. irregularis*, as well as *G. obliqua*, to be considered as individuals of *G. cymbium*, whose large, attached surface, has deranged the entire form of the shell."

ZIETEN figures, as *G. incurva* var. *lata*. the *G. obliquata* of these pages, stating that it is found with *G. incurva* in great numbers, particularly at Betzgemuth, near Boll, while OPPEL treats it as a distinct species, and makes it the leading shell of a particular zone, above the *A. oxynotus* bed, and immediately underlying the Lias Gamma of Quens-tedt. With OPPEL's observation, as applicable to our own district, we entirely disagree, as we find specimens of *G. obliqua* plentifully with *G. incurva* wherever it occurs, (of which it can easily be proved to be but the half grown stage,) exhibiting all the eccentricities of which that form is susceptible.

The shell which he calls *G. obliqua*, and places doubtfully in his

A. "Jamesoni-bed," we shall mention with the *Gryphæa* of the marlstone series.

CHAPUIS and DEWALQUE, in their "Description des Fossiles des Terrains Secondaires de Luxembourg," consider the following to be Synonymes of *Ostrea irregularis* of Münster in Goldfuss, "1835, Petrefacten, plate 79, figure 5," which they adopt as occurring in the "Sable et Grés de Martinsart," and the "Marne de Jamoigne," (the first and second stages of their inferior lias,) which corresponds nearly enough with its stratigraphical position in other localities, and consequently admits the application of the observations of OPPEL and QUENSTEDT, already cited, in which it is treated as merely a variety of *G. incurva*, of

Ostrea Laeviuscula Münster, fig. 6, plate 79;

O. ungula Münster, 1835, Handbuch, 325, (jeune);

O. semicircularis Römer, 1836, plate 3, fig. 6;

O. irregularis, D'Orbigny, 1850, Prod. t. 1, p. 238;

O. intermedia Terquem, (MS.) 1853.

LYCETT, with regard to the *Gryphæa Buckmani*, in our transactions, remarks—"The adherent species will be found to exhibit greater variability than the others; it may consequently be inferred that the form is connected with a position which was accidentally attained by variation of the attached shell."*

It is useless to make further references to published descriptions of this oyster-like form, as most recent authorities coincide with the opinions which are here stated, and which derive additional support from a fact made known to us, since the commencement of these pages by an observer upon whose trustworthiness we can safely rely, Mr. TOMES, of Welford Hill, viz. that a perfect Gryphite form with the shell, well preserved, closely resembling young specimens of the *G. obliqua* or rather *G. Maccullochii* varieties, occurs in the White Lias of Bridgend, Glamorganshire, Figures 5, 5^a, 5^b, Plate 1, proving most

* Goldfuss, at the conclusion of his descriptions of Gryphites, makes the following observations:—

"It is evident, that in the Gryphites of the Liassic formation only, are combined those characters by which they can be distinguished as species from Oysters. Indeed, in those of the Oolitic formation, their near relationship to the Oysters is plainly shown; and in the Cretaceous, as well as in the Tertiary formations, are found several kinds, in the individuals of which the presence or the absence of the distinguishing character of Gryphites, appear to be attributable merely to accidental variations of form, for this reason, both *Ostrea truncata* and *Gryphæa navicularis*, are sometimes considered Oysters, sometimes Gryphites."

In reference to *Ostrea vesicularis*, tab. 81, fig. 2, a to p, from the Chalk, the young form of it, as there shown, is precisely that of a Gryphite, whilst with age it assumes the expanded, flattened form of the Oyster; he also remarks, that—

"Count Münster distinguishes from *G. truncata* (tab. 81, fig. 2, c, g, f.) the broad thin individuals with striated and flat upper shells, as *Ostrea vesicularis*, (tab. 81, fig. 2, a, b, c.) the first named, in fact, frequently assuming the narrow boat-shaped form of *G. arouata*." So interminable is the variety of which the entire family is susceptible.

satisfactorily that it exists considerably lower than even Quenstedt had ventured positively to place it.

There can be no doubt, that the great confusion of ideas which has existed with regard to what we consider to be one species, as evidenced by the hosts of synonymes for it, to which we have been compelled to refer, arose from that love of species making which characterized most of our earlier Palæontologists. No sooner did an abnormal form present itself, than it was seized upon and named as a new species, whilst the examination of the series would have shown its true connection with common types. In species of which the number varies so much individually, as in the oyster tribe generally, this precaution is most essential, to enable us to arrive at safe conclusions in this respect: the most *symmetrical* forms having been set up as types, whilst, in point of fact, these are rather exceptional than otherwise.

We can convince ourselves in the instance of *G. incurva* that this shell is capable of assuming every shape between that of a flat oyster and one of so different a development, as to have suggested the propriety of conferring upon the individuals exhibiting it, a distinct *generic* name. It has been shown, how the entire character of the shell has been affected, by circumstances which enforced upon it a more or less permanent adhesion to the body to which it had primarily attached itself;—that the lateral furrow, upon the presence or absence of which specific differences have been supposed to depend, is one of the most fallacious characters upon which they can be based. We can perceive that the differences between the assumed species of *G. incurva*, *obliquata*, *Maccullochii*, and *cymbium*, are less than those existing between the young, half-grown, or adult states of either. We know that other creatures, inhabiting the same sea zones, pass upwards from the point at which they first appear, through a greater, or at least as great, a stratigraphical range as either of these. Do we not then rightly pause before we draw sharp lines of demarcation, whilst neither the facts presented to us in the formation under consideration, nor our knowledge of physiological facts, as exemplified in the existing life of our own epoch, afford us any valid pretext for so doing?

To show in the clearest possible manner the nature of the differences to which we have just alluded, we here refer to a diagram constructed expressly for the purpose, representing *Gryphæa incurva* of the best known type, and fullest dimensions. By uncovering the drawing from its upper portion downwards, may be made to appear in succession, first, its oyster condition; secondly, that of *Gryphæa suilla*; thirdly, that of *G. obliqua*, *young*; fourthly, that of *G. obliqua*, *adult*; fifthly, *G. incurva*, *half-grown*; sixthly, ditto *two-thirds grown*; seventhly, *adult*; eighthly,

in its most aged form. A comparison of any of the forms we have referred to, may, by placing almost any two shells of different sizes in juxtaposition, so that the curves of their beaks shall be as nearly as possible parallel, will exhibit the same difference of degree between them, in quite as satisfactory a manner.

The names by which the numerous varieties have been hitherto known, and under which they are figured, may of course always admit of a certain use, as those of *varieties* only of *G. incurva*, as which they ought to be generally recognised. We have only further to remark, that the repetition of the differences of character specified by various writers in the forms which it has been our principal object to prove to be varieties of one species only, would be, in connection with the artistic illustrations so ably rendered by Mr. Bone, and the preceding observations, superfluous. We simply invite attention to the fact, that not only is there no clear distinction between them when studied in a fairly selected series; that no particular form is special to any portion of the Lias of which we have yet treated stratigraphically; but that in our district, wherever Gryphites numerously occur, all the forms most widely diverging from the ordinary type of *G. incurva* are found, presenting differences from it, so infinitely modified as to make arbitrary separation between them of specific value, quite as unintelligible as absurd. These observations may be applied with equal propriety to other species and genera of shells equally common in the Liassic strata.

The accident which prevented the writer being present to read this paper, has also prevented his perfecting his references to the next species in stratigraphical order, which will be made the subject of a further communication to the Club.

On some Flint Instruments, and the Geological age of the deposit in which they were found upon Stroud Hill. By JOHN JONES.

READ AT DUDLEY, JUNE 17TH, 1863.

ONE of our Associates, Mr. E. WITCHELL, of Stroud, having observed during the excavation of a reservoir upon the brow of the hill upon which the town stands, that the superficial clay resting upon the Oolite was charged with land and freshwater shells, the writer, at his special invitation, accompanied him to the spot, and deems the observations then made to be of sufficient interest to lay before the Members of the Cotteswold Club.

The space occupied by the Reservoir is partially excavated in the Clypeus bed—the upper member of the Inferior Oolite,—the interstices of the rock being puddled with the tenacious clay, by which it was covered before the operations in progress commenced, and which, from the conformable manner in which it has been deposited, is evidently *in situ*, and must have extended far beyond the edge of the declivity near to which it is now exposed.

The total thickness of the clays laid bare at this point is from 15 to 20 feet, and their elevation above the sea is about 700 feet. A clearer idea of their position and correlation with other beds, than can be conveyed by words, will be obtained by reference to the accompanying plate.

Upon close examination, we find that the claybank represented as containing shells, flints, &c., consists of two formations of different ages.

The lower portion is the unfossiliferous retentive clay of the Fullers-earth, by which the percolation of water is arrested, and which forms the true basin of supply for the artificial reservoir now forming.

The middle portion, to which we invite special attention, appears at the first glance to be merely a continuation upwards of the last, the argillaceous elements of which it is principally composed, being manifestly the same, and obtained from its disintegration; but interspersed with a few broken and worn shells of *Ostrea acuminata*, the characteristic shell of superior beds of the same formation, are found great numbers of land and freshwater shells, belonging to species of Mollusca, which are still common in the district, and which we shall fully enumerate with other objects to be described.

Much of the soil from this portion, upon immersion in water separates into a fine, almost impalpable, sediment, which readily permits the extraction of the imbedded shells, free from stain and fracture, in the same degree of perfection as those from the well-known *Pleistocene* freshwater beds, at Grays, in Essex, from which indeed, if mingled with them, they could not be distinguished.

The upper portion of the bed cannot be separated by its organic contents from that which we have just described, but upon its surface becomes lighter in colour, from the greater admixture of calcareous matter, which hardens upon exposure into a lighter-coloured spongy-looking substance, resembling the Tufa formed in the neighbouring streams, indicating the probable exhaustion of the clays, upon which the water action which formed it had been exercised, and the consequent, though less considerable, corresponding action upon the calcareous beds below them. The significance of these observations can only be appreciated when connected with circumstances to be mentioned hereafter. No trace of water-course or ancient pond exists near the spot, and we know that the streams of all the valleys immediately around us have their sources in the waters collected by the Fullers-earth bed first mentioned, precisely as those of the upper or North Eastern portion of the valley where this does not occur, originate in the clays of the Upper Lias, where they crop out upon those slopes of the Cotteswolds, the water-shed of which finds its way to the Severn.

It is difficult to imagine that the recent deposit could have been formed since the bed upon which it reposes assumed its present angle of inclination towards the valley, as its thickness at the point of section proves that its outward extension must have been considerable. As we know that no trace of it is found upon the summit of the hill, which is occupied by a great Oolite bed, stratigraphically higher than that which supports it, dipping moreover at an angle of two degrees only towards the E.S.E., we may be satisfied that it never existed there, and can extend inwards or upwards but to a small distance, easily estimated, were it of any importance in answering the questions which naturally suggest themselves, viz. : when, and under what circumstances, was it formed, and were its margins swept away ?

We have only to glance at the two outer headlands of the inlet, to be reminded that the great valley upon which we look down, is entirely one of denudation, and that the space between us and heights of the same level, was once occupied by continuations of the hill-masses upon which we stand, as far, at least, as the older hills which form its opposite boundary ; we have to consider, therefore, in the changes of surface

which have occurred in this district, not so much the effects of water and atmospheric action upon exposed escarpments like those now exhibited to us, as those of an enormous erosive force upon a vast tract of nearly level country. As it is clear that this erosive force must have at first operated upon the surface, we may assume that it commenced during its slow emergence from the sea.

What may have been the highest bed in continuous sequence ever deposited here, we have no means of judging, but we know that denudation had affected beds, from those of the Great Oolite to the lower portion of the Fullers-earth Clay, upon which the freshwater deposit lies, before the latter could have been formed. As its organic remains are principally of creatures living under existing conditions near the spot where they are found, we may be sure that the excavating process had continued in operation upon the underlying beds for a lengthened period. As the fall of the upper beds towards the vale is manifestly produced by the excavation of others beneath them, we must infer that this took place at a period very remote as regards historical time ; for the removal of these, which were probably loose Pisolitic beds, or the Upper Lias Sands, can only be attributed to the time, at which the eroding power had produced the outline of the present basement beds of the Cotteswolds.

Series of falls, leaving terrace after terrace of rocky beds, displaced by the removal of the last-named strata, resting at various distances from each other upon the sides of the hills, and at different angles of inclination, may be seen so frequently, as at Haresfield, that we cannot hesitate to ascribe the deep covering of oolitic detritus, which almost everywhere here renders it difficult to ascertain what beds are really *in situ* beneath, to a similar origin. The fact of finding the freshwater formation accompanying the dislocated beds in their descent, is sufficient to prove that it occupied the same relative position to these, as that in which we find it, prior to their fall.

The excavation of the vale still continued far below this point, as we subsequently learn from the examination of the mass of deposit by which great cavities have been partially refilled ; we must consequently conclude that the freshwater bed must be at least as ancient, if not more so, than any formed at a level below those whose excavation caused its displacement. We cannot doubt that during the whole period of denudation here, the dry land was peopled by animated groups analogous to those which inhabited the surrounding country, and, as organic remains can be our only guides to any trustworthy approximate conclusion upon the first point, and what the character of the land might be, we will proceed at once to examine them.

The Univalve shells are as follows :

<i>Helix nemoralis</i> ,	<i>Clausilia nigricans</i> (?)
„ <i>rotundata</i> ,	<i>Succinea putris</i> (?)
„ <i>umbilicata</i> ,	<i>Zua lubrica</i> ,
„ <i>fulva</i> ,	<i>Limnæus truncatulus</i> ,
„ <i>pulchella</i> ,	<i>Cyclostoma elegans</i> ,
<i>Zonites alliarius</i> ,	<i>Carychium minimum</i> ,
„ <i>nitidulus</i> ,	<i>Acme fusca</i> .
„ <i>excavatus</i> ,	BIVALVES.
„ <i>crystallinus</i> ,	<i>Pisidium pusillum</i> ,
<i>Pupa umbilicata</i> ,	„ (?)

As all these creatures are still living around us, their habits and the conditions requisite for their well-being, known to us, from a consideration of the latter we may reasonably assume that they have been in all time what they are now ; reasonings, therefore, based upon this knowledge, are as likely to be correct, when applied to their existence in distant Geological time, as when applied to their occurrence in regions far distant from each other in the present day.

Helix nemoralis inhabits woods and gardens, and *Helix umbilicatus* the loftiest, and consequently driest, points of the hills.

Cyclostoma elegans is found amongst the moss, which usually covers the loose rubbly Oolite upon the summits and sides of the hills, and affects chalk and limestone districts generally, betokening, therefore, a certain predilection for a dry habitat.

Pupa umbilicata we have usually found in the moss covering old walls and under stones ; GRAY says, also under the “ bark of trees in shady places.” The teeth of these specimens are unusually prominent, showing that the animals existed under circumstances favourable to their most perfect development. *Clausilia nigricans* does not differ sufficiently in habit to call for special notice, but those which follow are of entirely different character.

Zonites alliarius and *excavatus* are found under stones with *Helix rotundatus*, or in situations in a slight degree more damp. *Zonites nitidulus* sometimes with the above, but generally in places still more humid. *Helix pulchella*, *Zonites crystallinus*, *Carychium minimum*, and *Acme fusca*, amongst wet moss in all situations, from that which fringes the margin of the streams, upwards, and in the decaying leaves of the beech woods which crown the hills—the last-named rare, *Carychium* exceedingly abundant. *Zua lubrica* inhabits moss in damp localities, as upon the banks of the Gloucester and Berkeley, and Newent canals, but generally in situations where the animal can adopt at will, the degree of

moisture necessary for its existence, by change of position. *Succinea*, of which we find no adult specimens, unless they are of stunted growth, or that the outer portion of the shell from its extreme tenuity and fragility has not been preserved, is a truly amphibious shell, frequenting rank herbage, in the most humid situations, and occasionally without any apparent necessity, immersing itself in the rill or pond in whose vicinity it exists.

A *Pisidium*, which from its want of concavity appears to coincide more nearly with the descriptions of *P. cinereum* than that of *obtusale*, and *P. pusillum*, are the only other water shells found here—both being found in small ponds in many situations.

From the consideration of the preceding list of Mollusca, the conditions under which the deposit was made suggest themselves with a certain degree of clearness. There were probably thickets near, and moss-clad soil, from which, as they dropped and died, the *Helix nemoralis* and *Cyclostoma* were washed by storm torrents to a lower level. A torrent of sufficient force to disturb and finally entomb these, would more easily scour the mosses of the damp uncultivated district over which it coursed, bearing from their habitats in numbers proportioned to their smallness, the others named in the list, as *Carychium*, *Pupa*, *Zonites*, and *Zua*.

The *Pisidium* and *Linnaeus*, from their active and hardy habits, are precisely the shells which we might expect to find in such a locality.

A somewhat similar assemblage of shells may be found in the small boggy patches, which are still in the course of formation upon the sides of May Hill, under circumstances closely analogous to those suggested in the older instance. The space of time during which these operations of nature have continued, can only be duly estimated by those who have carefully inspected the deposit, and examined the material of which it is composed.

It was our intention to have examined the finer portion into which it resolves itself in water, for Diatomaceæ, but the short time afforded by the interval between our visit and this meeting has not permitted us to fulfil it.

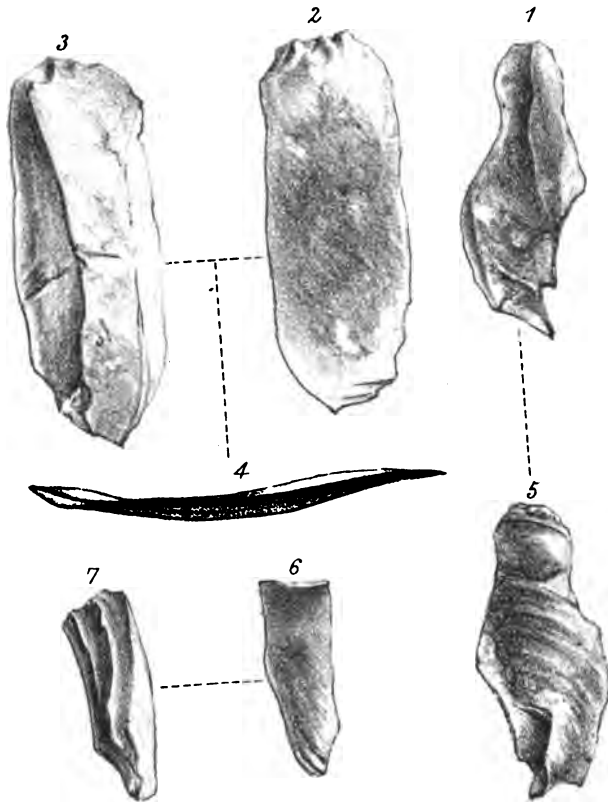
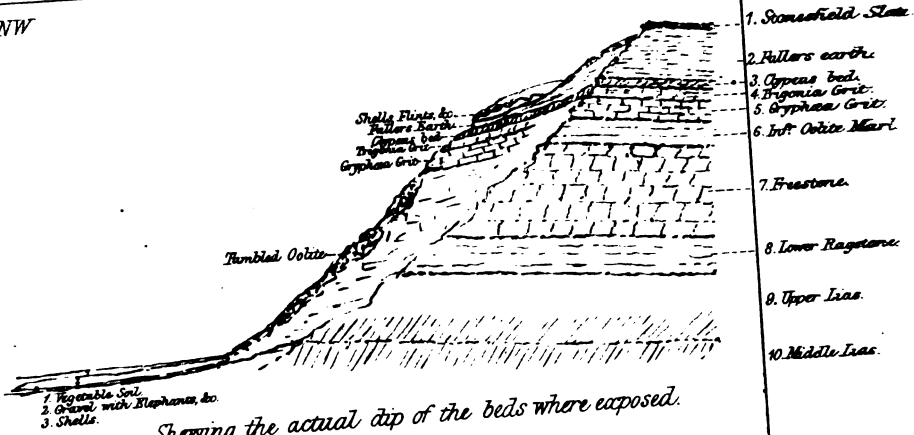
The conditions requisite to form such a deposit at this spot have long ceased to exist, but it is not improbable that the elevating or disturbing force, which has given to the Cotteswold range its normal dip of about two degrees to the S.S.E., exerted itself subsequent to the deposition of this sedimentary bed, for which opinion reasons may be assigned; and this would have sufficed to alter the entire character and direction of its water-collecting system. The application of this remark may not be readily apparent, but, looking across the Severn to the hills of the Forest

of Dean, we are reminded that the dip mentioned commences there, affecting all the intervening beds, from the upper portion of the New Red Sandstone to those of the Great Oolite near us, and the beds more especially under consideration. At this point, and in many neighbouring places, as before remarked, the Oolitic beds upon the edge of the hill are not in their original position, and were accompanied, when the change took place, by the more recent formation, indicating that this must have been deposited where we find it prior to their disturbance. Previous to the scooping out of the picturesque "combes" around us, which contribute so much to the beauty of one of the finest landscapes of its kind in England, the now distant hill-tops must have formed portions of a widely-continuous level tract, presenting, probably, the features of a dreary upland moor, alternations of morass and thicket, the deposit before us possibly representing the bottom of one of its ponds of considerable capacity, subject to accession of sediment, from the effect of storm torrents or periodical rains upon the land surrounding it.

Of the period as computable by years, during which these creatures have existed, we can no more form an idea than of any other beyond the pale of history or tradition, but we are informed of the contemporaneous existence of man, by the presence of flint instruments with cutting edges, carbonised wood, oolitic stone changed in colour by the action of fire, the bones of animals, a portion of a deer's antler, apparently that of the red deer, and what, from the description of the workmen who had not cared to preserve it, was probably the tusk of a boar, all in close proximity. These objects were found in about the middle of the second bed: the flint instruments by Mr. WITCHELL; the others, with the exception of the tusk, by both of us together. No disturbance of the soil subsequent to their entombment, nor for the purpose of making it, was anywhere traceable; and had this taken place, it must have been apparent from the necessary displacement of the tufa-looking crust of the upper portion, which, as we specially remarked, differs much in lithological character from that in which they were found. One of the pieces of burnt Oolite, more resembling freestone than any of the beds above it, and probably from the slaty bed above the lower Oolite Marl, must evidently have been carried up to the spot upon which it was found, as well as the flints. All these objects were found, not in a heap, but in such relative positions as they might be expected to occupy on being thrown or dropped into a pond of moderate depth.

The flints are so admirably preserved, that their cutting edges are as well adapted to fulfil their purpose, as when they were first made; their

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J. Jones del.

Flints from Stroud Hill.

M^r Mackay lith.

appearance, in fact, is such as to induce any one, not cognizant of the circumstances of their discovery, to pronounce them at once to be of recent fabrication, and, from the precision with which the direction of the fractures is given, that they were produced by the most perfect appliances of modern ingenuity.

The accompanying lithograph, representing them of their exact size, is sufficient to show by how few strokes their shape was produced. Having obtained a flake from a flint of considerable size, the smooth plane of fracture from which is shown on the under side in *fig. 2*, two other strokes would seem to have produced the sloping surfaces on the sides, shown in *fig. 3*, the central portion representing the worn and discoloured surface of the larger mass from which it was originally detached. It will be observed that these specimens are all of the rudest type, and it is probable that the peculiar colour of the largest has been produced by fire. As little appears to be known respecting the manufacture of such flints as we still use, the following remarks may be found of some interest in connection with the subject.

It is not to be supposed that the men who made these flint instruments used the means applied by modern gun-flint makers; but that they had arrived at an equal degree of knowledge as to the kind of stone which would suit their purpose, or not, from observations forced upon them by long experience, is certain. The manufacture of gun-flints has been a secret in our own times, and the signs by which the flints fit for this purpose were chosen, have not been generally known until M. Dolomieu published an account of the method practised in France some years since, in the "Memoire de l'Institute Nationale des Sciences," from which it appears that only large flints, varying in weight from two to twenty pounds, were made use of. Their colour should be uniform, their fracture perfectly smooth and equal throughout, and (as in the case before us) slightly conchoidal, the last property being the most essential; as upon it depends the facility with which the nodules are divided; whilst their transparency should permit of letters being read through a flake of a quarter of a line in thickness, when laid close upon the paper. Flints which do not readily exhibit these characters are rejected as intractable, but where they are otherwise, an expert workman, by the aid of "several hammers and a chisel," can make a thousand in the space of three days. We need scarcely remark that, with the exception of a few small scattered fragments found in the gravel of the vale, no flints whatever are found within a distance of many miles of the county, and that the larger instrument before us is a flake from one of considerable size, will appear from its inspection. The circumstance of the bones of animals, which have probably

always been the favourite food of primitive man, having been found with flint knives, fire-marked stones, and charcoal, in many instances, if not conclusive as to their intimate connection with, and relation to each other, are surely sufficient evidences of the co-existence of man at the same period with them.

There is a peculiar aspect about the small group of shells enumerated which may be worthy of more attentive consideration. With the exception of *Zonites excavatus*, which hitherto has been found in Great Britain only, they are extensively distributed over Europe, indicating, from the wide distance apart of the extreme points at which they have been found, great indifference to, or capability of enduring considerable difference of climate; with one exception again, that of *Helix umbilicatus*, (whose habit of affecting the highest points of the rocks upon which it is found has before been mentioned, and whose absence may therefore be readily accounted for in flat or low-lying localities,) all have been found fossil in the Pleistocene freshwater deposits at Grays, Copford, Clacton, &c., and in others equally well known of similar age. These facts will be better understood by inspecting a list which will exhibit at a glance, their relations to the views at which we arrive from their study.

Living in the District.	Living in distant Countries.	Fossil in Pleistocene Freshwater Deposits elsewhere in Britain.
<i>Zonites alliarius</i>	Dalmatia	Charing
„ <i>excavatus</i>	Britain only	Stutton
„ <i>crystallinus</i>	Sweden, Spain... ..	{ Clacton, Copford, Maidstone
<i>Helix nemoralis</i>	Sweden, Dalmatia	{ Stutton, Clacton, Copford, Maidstone
„ <i>rotundata</i>	Sweden, Sicily	{ Clacton, Copford,
„ <i>umbilicata</i>	„	{ Grays
„ <i>pulchella</i>	{ Sicily, N. America Canaries	{ Crophorn, Stutton, Clapton
<i>Pupa umbilicata</i>	Dalmatia	Clacton Copford,
<i>Clausilia laminata</i>	Sweden, Sicily... ..	Clacton, Copford
<i>Zua lubrica</i>	Sweden, Sicily... ..	Grays, Copford
<i>Succinea</i>	{ Sweden, France, and Germany	{ Crophorn, Clacton, Copford, Stutton,
<i>Limnceus truncatulus</i>	Sweden, Greece	{ Crophorn, Clacton, Copford, Grays, Stutton
<i>Cyclostoma elegans</i>	Dalmatia	Maidstone, Gedgrave
<i>Carychium minimum</i>	Sweden, Germany	Grays, Clacton
<i>Acma fusca</i>	Spain	Stutton, Maidstone
<i>Pisidium pusillum</i>	Sweden, France	Grays, &c.

In juxtaposition with these we place another table, showing the mammalian remains with which they are found associated elsewhere :—

PLACE FOUND.			
<i>Arvicola agrestis</i>	...	...	Grays, Crayford
„ <i>amphibia</i>	...	...	„ „
<i>Bison priscus</i>	...	...	Kent, Essex, Yorkshire
<i>Bos primigenius</i>	...	...	Grays, Ilford
„ <i>longifrons</i>	...	...	{ Berks, Essex, Middlesex, Witshire, Ireland
PLACE FOUND.			
<i>Capra hircus</i>	...	...	Walton, Essex
<i>Castor Europæus</i>	...	...	Grays
<i>Cervus capreolus</i>	...	...	Bacton
„ <i>elaphus</i>	...	...	Norfolk, Essex
<i>Elephas primigenius</i>	...	...	Valley of Thames, &c.
<i>Equus fossilis</i>	...	...	Grays, Clacton
<i>Felis leo</i>	...	...	„
„ <i>spelæa</i>	...	...	„
„ <i>catus</i>	...	...	„
<i>Hippopotamus major</i>	...	...	{ Grays, Ilford, Brentford, and Folkstone
<i>Hyæna spelæa</i>	...	...	Erith, Kent
<i>Macacus phiocænus</i>	...	...	Grays
<i>Megaceros Hibernicus</i>	...	...	{ Essex, Norfolk, I. of Man, and Ireland
<i>Palæospalax magnus</i>	...	...	Bacton, Norfolk
<i>Rhinoceros leptorhinus</i>	...	...	Clacton, Ilford
„ <i>tichorinus</i>	...	...	Chartham, Kent
<i>Sorex fodiens</i>	...	...	Bacton, Norfolk
„ <i>remifer</i>	...	...	„ Ostend
<i>Sus scrofa</i>	...	...	„
<i>Talpa vulgaris</i>	...	...	„
<i>Trogontherium Cuvieri</i>	...	...	{ Bacton, Cromer, Norfolk, and Siberia
<i>Ursus spelæus</i>	...	...	Essex, Norfolk.

Amongst these, accepting the specific determinations of OWEN and others, the field and water Voles, the cat, the red deer and roebuck, the goat, the water and oared shrews, the mole, and the common pig are still living in Great Britain. The Aurochs (*Bison priscus*) still exists, though untamed, by the forbearance and under the protection of man, in Lithuania, Wallachia, and some districts of the Caucasus.

Our breeds of domestic cattle are presumed to be descendants of *Bos longifrons*. Remains of the Beaver have been found in the neighbouring Nailsworth valley, at no great distance, as recorded by Mr. LYCETT in his "Cotteswold Hills," and we know that it was found in Wales as late as the twelfth century, and is now living in remote parts of Europe. A full half, then, of the animals recorded in this list are still living, and the majority of that proportion, moreover, in this country. With the exception of the Horse, no genera allied to those of the great Pachyderms, whose bones we find sparingly scattered through the gravel, as Elephas, Hippopotamus, Rhinoceros, or to Hyæna, are found in Europe, or in corresponding latitudes over the world, whilst each is fully represented in tropical or sub-tropical climates, as well as the great cats, the monkey, the bear, and the undomesticable species of ox and deer.

What is the natural conclusion to which an intelligent blending of these tables brings us? We have no more reason to doubt that all these creatures, from the tiny *Carychium* to the huge elephant, lived *here* at the same time and together, than that they did so in the valley of the Thames, where their mingled remains have occurred still more abundantly. It may be remarked that, with the exception of the deer and boar, none of the mammalia in the table have left their traces in the hill deposit, but we have yet, in due order, to mention a circumstance which will effectually obviate any objection offered upon that ground. With regard to their known simultaneous occurrence elsewhere in Britain, and present geographical distribution, may we not reasonably infer, as suggested by LYELL, that during the Pleistocene fresh-water deposits, this country formed the extremity of a great continent of such genial temperature and climate that, whilst not too cold to be endurable by the organic forms now confined to southern latitudes, it was not hot enough to drive northwards those which now inhabit it? The mere calling over the roll in which their names are given, is suggestive of a climate intermediate to what we now call tropical and temperate, by a refrigerating change in which, whilst the northern forms were unaffected, the tropical forms became extinct, as stated by LYELL. We shall endeavour to show that this theory is not destitute of support, from circumstances which present no great obstacles to their verification. The period to which their remains have been generally referred is that at present called "Lacustrine" by local geologists; but with regard to the mode in which the gravel deposits in which they occur in our district have been accumulated, and the "combes" and "bottoms" formed, we feel satisfied that no mere accumulation of lakewater or ordinary current action will reasonably account for either. As our observations upon this subject would make

the present paper much too long for this meeting, we reserve them for future communication.

Looking towards the hill-top, we are reminded by the equivalents of the Stonesfield slate, or other beds still higher in the series which occupy it, that between the Fuller's-earth bed upon which we stand, and that in whose detritus like shells and remains are embedded to the eastward all the Upper Oolitic, Wealden, Cretaceous, and Tertiary formations are interposed; and however great may be, in our view, the antiquity upon which we insist for our protégés, what insignificant parvenus they become when compared with their predecessors of whatever kind in any bed beneath them. Here we are compelled to pause and recognize the lapse of a vast epoch, of which the only record remains in the evidence of erosive power by which the combs around, and broad vale before us, have been produced, and by which enormous rock masses spread over a great tract of country have been swept away, from the highest of the Jurassic system developed here, to those of the Silurian May-hill Sandstone, and Conglomerates. Over the formations thus denuded flowed the sea which separated the principality of Wales from England by the Straits of Malvern, as traced by Murchison, Strickland, and Buckman, of whom the last named has more particularly brought the fact under our notice in a special treatise.

By an attentive summary of the facts there recorded, conviction may be arrived at, as regards the truth of the theory which it was desired to establish, although no particular effort is there made to solve certain difficulties presented by the subsequent accumulations of gravels and drift in the space once occupied by the ocean waters, and upon these we will venture a few remarks. When we examine neighbouring straits, accessible to tidal action, we find that the central point, or that where the opposing currents meet, as might be expected, is the most favourable to resistance of erosion and deposit of sediment; this therefore, upon the bodily gradual elevation of the region into the state of dry land would be the first exempted from the as constantly retroceding action of the tides. A peninsula once formed, we may follow with tolerable accuracy, although but in imagination, the changes which followed. The opposite shores of its isthmus necessarily became the heads of two deep inlets, which finally subsided into the estuaries of the Severn and Dee, the once, when debouching into the strait, insignificant streams, now expanded into the great waterveins of the newly exalted land; may we not thus account for the more frequent occurrence of sea shells at present existing in the British, St. George's, and Bristol Channels, at Bridgnorth, and other localities in Shropshire, Staffordshire, and Worcestershire, than

at levels which must have been subject to alternations of encroachment and silt deposit, long after the districts mentioned were dry land, subject only to atmospheric disintegration; and may we not also, attribute the persistency with which marine plants cling to such spots as Longdon Marsh, not so much to its having been a shallow backwater of the Severn, as to its having been a deep hollow of the old strait, forming, when isolated from it, a reservoir, first of truly salt and then of brackish water, whose saline particles are still to a great extent retained by the soil. Upon this supposition we can conceive why such plants as *Scirpus maritimus*, and others mentioned in Buckman's Essay, are found growing here and in similar localities, though absent in others throughout tracts more frequently inundated by the Severn, and constantly washed by its tides.

We may here make a few brief remarks upon the correlation of the lake period, upon which Mr. SYMONDS has more than once ably addressed us, and of the existence of which no more doubt can be entertained than of the Strait of Malvern, with the freshwater deposit to which I have called your attention.

The conversion of the bed of the strait into dry land must, of course, be attributed to its elevation, and not to the recession of its waters.

The physical characters of the country, through which the Severn flows, suffice to inform us that its course must have been barred at various points, by obstacles which have since been cleared away by its own long operating powers.

We know that the oolitic capping of the hills gradually thins out westward, and from the entire absence of any trace of it, except in its drifts, we believe that it did not extend from its present escarpments farther than the upturned edge of the forest coal basin in this district, against (not upon) which it rested conformably with the lias beds, which we still find in that position at Awre, Westbury, Purton, and Beachley; we can therefore readily imagine the damming up of the waters of the Severn and its tributaries, to involve the existence of series of large freshwater lakes, for any indefinite period.

Now if we glance at the course of the river upon the geological map, we *must* remark that it has finally forced itself into communication with the sea, at precisely the point, which, given the stratigraphical conditions, might have been predicated; where, in fact, the unconformable conjunction of two rock-masses of very different degrees of coherence, one being particularly susceptible of frost and general atmospheric influences, afforded the most direct and readiest line of egress.

We know that the rocks upon the opposite side of the channel, which

had been thrown up long before an atom of the secondary rocks had been deposited against them, from their greater compactness and durability, presented materials better calculated to resist water action than the softer Oolite rocks, when brought into operation with equal force upon both, which ~~must~~ have been the case, and would therefore tend to the much more rapid disintegration of the latter. This must be apparent when we take into consideration the fact that, from want of exposure to the sun, these could not have been hardened and consolidated as we know them ; for it is only by complete and lengthened exposure that they even now become weather proof. Supposing the most constant direction of the winds and tides to have been the same as at present, which the conformation of the excavated valley goes to show, the erosive force would be principally upon the softer rocks, leaving the harder comparatively intact. That this was so, we may gather from the fact that the heads of most of the combs here are in the direction of the N.N.E., according with that of the tides, strengthened by the still prevailing W.S.W. winds, the currents being thrown off, moreover, in the same direction from the spurs of the older hills, and producing corresponding depressions in those of the secondary formation.

Thus we find the old limestone rocks thrown up at acute angles, as ramparts around the coal formation, and preserving the measures within them little abraded, whilst the clays and shales above the coal have been greatly denuded, and form what may properly be called basins within them. A glance at the map and sections proves this.

That its course may have been modified or influenced by analogous circumstances, in its upper portions, seems more than probable, but this fact, for want of positive personal knowledge, we remit for future verification. Are there no circumstances to show that the perpendicular cliffs of Westbury, Wainload, and the Mythe, are comparatively modern faults ? but of the occurrence of these we may have to speak hereafter in the promised paper. As the lake period is presumed to have contributed to our local geology the great bulk of the oolitic gravels, which, with their interesting contents, strew the vale of Evesham, Gloucester, and Berkeley, we shall briefly mention, in connection with these, a fact which has come to our knowledge, within the last week, communicated, like that which heads the paper, by Mr. WITCHELL, whose acuteness of observation, assiduity in collecting facts, and liberality in imparting them, since he has commenced the study of geology, are entitled to the highest credit. The oolitic gravel in question is too well known to require here any particular description, it will therefore be sufficient for our purpose to remind you that along the sides of the Cotteswolds, in addition to fossils from almost

every bed from the lower lias to the great oolite, indicating clearly those from which its materials have been derived, it contains the bones of Elephants, Rhinoceroses, and Hippopotami, some of which are now laid before you, and that for the most part in the Gloucester end of the vale it rests immediately upon the denuded beds of the lias.

The bones of these great Pachydermata, more or less abundantly scattered over the area of the deposit, are sufficient to prove the existence of these animals, when the said deposit took place in the country of which it is the detritus.

These bones have been found fossil in Pleistocene freshwater deposits at Grays, Erith, &c., as before mentioned, associated with the identical species of shells, which we have submitted for your examination, in precisely similar condition.

At Gannecot quarry, near Stroud, as shown in the section at 3, on the left underlying about twenty feet of this gravel, immediately upon the lias, and below the elephant bones produced, some of these same shells are found, with many others, all of which belong to species now living in the district, and are supplementary as regards necessarily co-existent conditions, to those already described, as will appear from the following list.*

LIST OF SHELLS FROM BELOW THE GRAVEL.

<i>Ancylus fluviatilis</i>	...	...	Sweden, Sicily.
<i>Limnæus auricularius</i>	...	...
„ <i>pereger</i>	...	...	Sweden, Dalmatia.
„ <i>truncatulus</i>	...	...
<i>Helix nemoralis</i>	...	...
<i>Zua lubrica</i>	...	...
<i>Pupa muscorum</i>	...	...	Germany, Italy.
<i>Zonites excavatus</i>	...	...

The *Limnæads* and *Ancylus* are still as naturally looked for in the stream below us, as the *Helicidæ*, &c., would be sought upon the hill-sides or elsewhere. Taking these facts then into consideration, with the presence of human implements in undisturbed beds of apparently like antiquity, we believe them to be as good proofs of the contemporaneity of man with the great extinct pachyderms, as any which can be deduced from the position of the world-famous flints of Abbeville. So much has been written about these, and so many questions of deep scientific interest depend upon the establishment of their approximate age, that we considered it to be a duty to lay the present specimens, and what we believe to be the facts connected with them, before you.

* This must be regarded as by no means complete, as the shells named in it are the product of a few hours search; it might doubtless therefore, with little labour, be greatly extended.

Many of our conclusions are drawn exclusively from some details of recent Natural History, which may seem tedious to examine, but for ourselves we think that a critical acquaintance with the habitudes of tribes of animals might be brought to bear more frequently upon the solution of geological problems, with advantage.

We talk confidently enough of the conditions under which certain deposits were formed, from the most ancient to the most recent, of "coast lines," "deep seas," and "estuarine areas" of wide extent; but it appears to us sometimes with a seeming looseness, rather calculated to engender doubt or indifference, than to inspire confidence as to our theories, in others. These observations may appear trivial for want of a little more attention to detail, but we may reflect that with all our accumulations of facts, no man has ever yet presumed to say that the geological phenomena of a very limited area in a single formation, had quite unravelled their mysteries to his gaze, however scrutinising; his difficulties arising, probably, not so much from the want of power to deal with the generalities, as from the inability to appreciate the importance, and perceive the application, of special though apparently trifling, details. Adopting the principle, the value of which has been fully recognized by LYELL and DARWIN, that there is generally discoverable a degree of relationship between the present inhabitants of a district and those which immediately preceded them, we believe that the test here applied, in a limited space, is as satisfactory in its results as when made use of in their generalizations. In conclusion we have only to say that we have entered into this subject in the most humble spirit, seeking only for truth, and pretending to no degree of authority, still believing such investigations, by others who have more time and ability to devote to them, to come particularly within the scope of such provincial scientific bodies as those now assembled, and if honestly carried out to be likely to lead us as individuals to more satisfactory information than we have yet acquired upon many subjects.

Address to the Cotteswold Naturalist's Field Club. 1863. By the President
W. V. GUISE, F.L.S., F.G.S.

GENTLEMEN,—

The proceedings of the Club during the past year, and its position and prospects at this, the commencement of the present season, are such as to justify me in assuring you of our continued prosperity and success.

Our finances have served for the publication of the handsomest and most important fasciculus of papers which has been published by the Club for many years, for which we are largely indebted to the stimulus given by the appointment of a publishing committee two years ago. Mr. Jones's paper on "*Gryphæa incurva, and its varieties*," is the first-fruits of a resolution then adopted, of publishing figures and correct descriptions of the different groups of Jurassic fossils—a department of Palæontology, for the illustration of which our county offers peculiar advantages. It will readily be understood that plates finished with the needful precision and care—without which they are indeed of little use—cannot be executed without a considerable expenditure of money—that is, considerable with reference to our limited means—though the sum be in itself sufficiently moderate. That we have not overstepped the limits of our income is due in some respects to the fact that our expenditure in previous years was within our income, and thus a margin has been left beyond what was required for the expenses of the Club, which has sufficed for all our necessities. It is, however, evident to me, and I think you will concur with me in the opinion, that if we are to carry out our intention of publishing well-illustrated works, we must defray the necessary expenditure out of our annual income, without trenching upon the resources of the future.

I am unwilling, if it can be avoided, to ask for an increase of our annual subscriptions; but should there be risk that our work, and thus our usefulness, should be contracted through lack of funds, it would hardly be acting the part of either prudent or earnest men, to hesitate about increasing our subscriptions. In the meantime I am prepared to recommend that an entrance fee of one pound be for the future required from all new members; and I have the greater confidence in recommending the adoption of this measure, with a view to its yielding a source of revenue, inasmuch as I am of opinion that looking to the status of the Cotteswold Club, it may well be

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expected that those who are desirous of being enrolled in its ranks should be called upon to pay for what is in truth no barren honour.

It may be urged that the adoption of this rule would have the effect of checking the growth of the Club. And though I do not believe that such would be its effect—at least to any injurious extent—I should not be disposed to object to the exercise of a modifying influence in restricting somewhat a growth which has been of late very rapid, and which threatens unless a limit be put to our undue expansion, to create at no distant time an amount of business too great for an unpaid and unassisted secretary to perform. On that account, therefore, I am prepared to recommend that our numbers should not at any time be permitted to exceed 100—a limit amply sufficient to keep our ranks open to the working Naturalists of the County, and to protect us against the charge of exclusiveness, while for all practical purposes it would be sufficiently manageable.

It will be remembered that when three years ago you did me the honor to place me in the distinguished position which I have since held as your president, I found the Club in some respects an exclusive body, limited to 40 in number. This had its advantages and its disadvantages,—the principal advantage being that a small body was more easy to work than a large one. But this comparatively unimportant benefit was more than counter-balanced by the evil tendency inherent in so limited a society—a tendency to an exclusiveness, which, possibly useful in the earlier stages of association when enthusiasm is fresh and work new, has in process of time, as these stimulants become weaker, a tendency to produce languor and decay of interest, which in our case manifested itself in slackness of attendance at the meetings of the Club, accompanied by an almost total cessation of printed work. Under these circumstances I asked permission to throw open the Club, and to invite the co-operation of all lovers of Natural Science in the County, in the work of aiding to maintain the Cotteswold Club in the high position to which, under the skilful leadership of my predecessor in the chair, it had attained. The expansion and impetus thus given have since then been productive of all the advantages which I anticipated. A large infusion of fresh blood has brought with it renewed vitality. Our meetings have been invariably well attended, our papers have increased in numbers and in importance, and our list of members has gone on increasing, until the time appears to have arrived, when out of consideration to the labour of our secretary, it seems necessary to set bounds to our undue expansion.

It is with a view to effecting this purpose, while we at the same time employ the accession of fresh members as a means of enlarging our revenues, that I ask your approval of the proposal now submitted for your

acceptance,—not doubting that should the means suggested for increasing our revenues fall short of the object aimed at, the Club will readily consent to an increase of our subscriptions, rather than suffer the reputation of the Club to decay, or its work to be starved for lack of the requisite funds.

Having made these preliminary observations, I will now proceed to give a summary of the work done by the Club during the past season.

The annual meeting of the Club was held at the Ram Inn, Gloucester, on Wednesday, 26th of February, when the usual business was transacted, the accounts audited, and the officers for the ensuing year appointed; when you were pleased to manifest your confidence in me, by re-electing me to the office of president. The secretaryship, which had been held by Mr. JONES for two years with great advantage to the Club, was resigned by that gentleman, owing to increasing pressure of business interfering with his leisure, and Mr. LUCY was unanimously chosen to fill the vacant post.

The day's excursion was directed to an examination of the drifts of the Severn Valley, as exhibited in the neighbourhood of Gloucester.

The question of the distribution of the different beds of gravel, and their relation to one another, is one which has assumed a vast extension of interest and importance since the researches of Mr. PRESTWICH and others have shown that these beds are capable of sub-division into a higher and lower series, characterised by well-marked organic contents, amongst which the discovery both in this country and on the continent of Europe, of human works of art, associated with osseous remains of now extinct quadrupeds, have attracted to these beds an amount of attention proportionate to the novelty and importance of the arguments deducible from these startling discoveries.

The gravels in question are found distributed at various heights along the flanks of the valleys which bound many, perhaps most of our river-courses, and indicate the amount of water-action previous to the excavation of the present channels. Mr. PRESTWICH is of opinion that the constituents of these gravels are in all cases derived from beds now existing "in situ" along the valleys, and consequently that they have been brought down and deposited by the present rivers. He considers that these gravels may be divided into two distinct series, denominated by him "High Level" and "Low Level" drifts, the latter occupying a position but a few feet above the present water-level, while the former are to be looked for at heights varying from 50 to 200 feet above the level of the valley. Occasionally, however, beds of gravel are found at intermediate levels, leading to the conclusion that the "Upper-lying" and "Lower-lying" drifts must be regarded as the extremes of a continuous series, rather than as beds which owe their origin to separate and distinct influences. The "Upper

Level" gravels would necessarily be the most ancient, and the beds lying at the lower part of the valley the most modern. What, however, may be the value to be attached to these terms, *ancient* and *modern*, can only be measured by a careful consideration of the physiological circumstances attending the relative position of these erratic deposits, with reference to the under-lying strata. A careful review of the evidences bearing upon this interesting subject, especially those presented by the gravel-beds on the Somme, in which human works of art have been found in the "High Level" drifts, associated with the remains of the Mammoth and other extinct quadrupeds, have, however, afforded a standard of measurement which gives reason to believe that the presence of man in Western Europe dates from a period of time incalculably remote.

Along the course of the Severn valley in the neighbourhood of Gloucester, it is not difficult to trace beds of gravel which may be called "Upper" and "Lower" drifts. The former, occupying the summits of all the rounded hills, out-liers for the most part of the Lias, which like those at Hartpur, Maisemore, Apperly, &c., formed shoals in the ancient tertiary sea of the Severn Straits, and are capped by gravels which represent the first emergence of dry land as the river began slowly to subside into its present channels. The "Lower drifts" are represented by beds of gravel at the very base of the valley, but little elevated above the highest margin of the river. Both sets of gravels have this feature in common, that a large portion of their constituent mineral contents are derived from the degradation of the Old Red Sandstone, mixed with chalk flints, and portions of traps and sienites, derived in many cases from very remote sources. But with these features of agreement, this difference is observable, that whereas the more ancient gravels exhibit little if any traces of oolite detritus—the lower beds are largely formed, especially on the eastern side of the valley, out of the constituents of the oolitic rocks. This at any rate is noticeably the case in those beds examined by the Club at Highnam and Over, and those which they inspected at the summit of Maisemore Hill. At the latter locality not a vestige of oolite could be detected, even in the minutest grains, while at the former station that mineral was seen to form one of the principal constituents of the beds.

This subject is still too obscure to permit of any beyond the broadest generalization, and it is difficult to lay down any canon by which to determine with any degree of exactitude the relative horizons of these erratic deposits, which higher up the Severn, as at Upton, present a sectional arrangement so closely resembling that of the same beds at Menche-court and Moulin Quignon, on the Somme, even to the Lacustrine Silt in the valley, that the one section may be said nearly to repeat the conditions

of the other. But at Gloucester, it seems no longer possible to correlate the beds with those higher up the valley. Mr. SYMONDS, who has made a study of this intricate subject, informs me that he has "never seen any gravels near Gloucester which he can correlate with the well-marked terraces, near Worcester, at Upton, and on the Avon, at Crophorne." He is disposed to consider all the drifts near Gloucester, as belonging to the *High Level* series, such as those of Tunnel Hill, near Upton, and Shut-honger, beyond Tewkesbury.

The obscurity which surrounds this question is further complicated in the Gloucester district by the difficulty of measuring the effect of *tidal action*, which must be largely taken into account in any computation of the forces which contributed to the formation of the existing gravel-beds; forces which must not only have disturbed and re-arranged the materials of olden drifts, but must have been the means likewise of commingling with the gravels borne downwards by the natural current of the river, a large proportion of detritus derived from beds in an opposite direction. Our colleague, Mr. JOHN JONES, expresses an opinion derived from a long study of these estuarine conditions, that a large proportion of the transported deposits in the lower portion of the course of the Severn owe their origin to such influences, and that the limestone and chalk flints which are there met with in such profusion, may be traced to beds which have been denuded and broken up to the south-westward, in the direction of the present outflow of the river.

The further prosecution of this question, which is one full of novelty and interest, I strongly recommend to the Cotteswold Club, as being well within the scope of their observation, and one which will repay a long, careful, and elaborate study. There are teachings, depend upon it, which have yet to come from these phenomena, which it will tax the skill of our ablest geological experts to develope.

Wednesday, 14th of May. The Club met at Cardiff, with a view to an examination of the Junction-beds between the Lias and the New Red Sandstone, at Penarth, of which beds the section at that locality is one of the most complete and instructive to be met with in the West of England, extending from the Lima-beds of the zone of "*Am. planorbis*" to the base of the Lias, thence through the so-called Rhætic beds of Moore, and a considerable thickness of the uppermost Keuper deposits.

The party commenced their observations at the Northern extremity of the excavations above the new dock, where the following succession of beds was measured and tabulated in ascending order from the Keuper marls:—

- | | | | | |
|---------------------|-----|-----|-----|------------------|
| 1. Black Shales ... | ... | ... | ... | 4 feet. |
| 2. Bone-bed ... | ... | ... | ... | 1 foot 5 inches. |
| 3. Black Shales .. | ... | ... | ... | 9 feet. |
| 4. Lower Pecten-bed | ... | ... | ... | 8 or 9 inches. |
| 5. Black Shales... | ... | ... | ... | 7 feet. |
| 6. Upper Pecten-bed | ... | ... | ... | 7 or 8 inches. |
| 7. Black Shales... | ... | ... | ... | 3 to 4 feet. |
| 8. Estheria-bed ? | ... | ... | ... | 4 inches. |
| 9. Monotis-bed ? | ... | ... | ... | 10 or 12 inches. |

To these succeed a series of Shaly beds, having intermittent bands of grey stone, intercalated in the lowermost layers abounding in *Ostrea liassica*, *Modiola minima*, *Cardium*, and *Myacites*.

At the Southern extremity of the excavation, the beds above the Upper Pecten-bed were examined, and the following succession tabulated in ascending order:—

- | | | | | |
|---|-----|-----|-----|------------------|
| 1. Black Shales ... | ... | ... | ... | |
| 2. Indurated Marls | ... | ... | ... | 1 foot. |
| 3. Compact Limestone band | ... | ... | ... | 6 inches. |
| 4. Shaly Limestone | ... | ... | ... | 1 foot 4 inches. |
| 5. Intermittent band, containing <i>Cardium</i> | | | | } 1 foot. |
| <i>rheticum</i> ... | ... | ... | ... | |
| 6. Compact dark-coloured Limestone con- | | | | } 4 inches. |
| taining comminuted Shell | ... | ... | ... | |
| 7. Shaly-beds, assuming a more compact | | | | } 12 feet. |
| structure in the upper layers | | | | |
| 8. <i>Ostrea liassica</i> beds | | | | |

The following list of fossils from the bed marked 7 was noted:—

Area, sp.

Lima punctata.

Modiola minima.

Cardium rheticum.

Axius, sp.

Together with many other *Rhetic* forms.

These shales, together with the under-lying limestones, were assigned by the geologists present to the "White Lias," to which, from their position and contained fossils, they were adjudged to belong.

The fine section at Pennarth Head displays the whole series of beds at one view. Here, upon a Keuper base of great thickness, seamed throughout with white layers of gypsum, the *Rhetic* and Lower Lias beds are exhibited in a grand escarpment calculated at not less than 200 feet.

This is a very valuable section, and when compared with those at

Westbury, at Uphill, near Weston-super-Mare, and others, affords valuable materials towards the elucidation of the beds intermediate the Planorbis beds of the Lower Lias, and the red marls of the Keuper, wherein the persistence of the Pecten beds, the *Bone-bed* and its remarkable organisms, with the accompanying Black Shales, will be remarked as indicating a geological series as complete in itself as it is in many respects divergent from the beds above and below. Mr. CHARLES MOORE identifies this series of beds with the so-called Rhætic beds of Gumbel, and then assigns to them a separate and distinct value in the geological scale; while, on the other hand, our able colleague, Dr. WRIGHT, is at present disposed to regard them as a portion of the Keuper series, of which they constitute, in his opinion, the uppermost member.

From Penarth the party proceeded to Llandaff, where the renovated glories of the fine old Cathedral elicited warm expressions of admiration at the excellent taste displayed in the restoration of the lately ruinous structure. So successfully indeed has the modern architect supplemented the plans of the original designers, that it is difficult to say where the older portion of the work terminates, and that of the restorer has begun.

After dinner, which took place at the Angel, Mr JONES's admirable paper on the Lias Gryphites was read, and an unanimous vote of thanks was accorded to the author for this very valuable contribution to the published works of the Club.

Wednesday and Thursday, 18th and 19th of June. The Club met at Weston-super-Mare, in Somersetshire, in pursuance of a plan then for the first time acted upon, of appointing that one of the meetings of the Club should be held outside the boundaries of the county, a plan which I strongly recommend should be made one of annual observance for the future. Such a divergence from the beaten path of routine which has hitherto confined the Club within its own frontiers, is calculated to act most beneficially, by opening out to us fresh fields for observation and research, thereby expanding our views and enabling us to institute comparisons between similar scientific facts as developed in our own county and elsewhere, while we are at the same time brought into contact with individual observers of congenial tastes and pursuits, and with Societies of Naturalists like our own, with whom we are thus enabled to make acquaintance, while at the same time exchanging notes and observations to the manifest advantage of all parties.

On Wednesday, 18th of June, a considerable number of the leading members of the Woolhope, Malvern, Bath, Bristol, and Somersetshire Natural History Societies, met us at Weston-super-Mare.

The principal object of this day's excursion was directed to the examination of the celebrated bone-cavern, at Banwell, and of the remarkable collection

of animal remains obtained from that and from other caverns in the neighbourhood, by the veteran BEARD, who has dedicated a life-time to that purpose, and has by his industry amassed a treasure of the highest interest and importance, which it is to be hoped will never be permitted to be dispersed.

Since publicity has been given to the very remarkable aggregation of evidence bearing upon the discovery in caves of the bones and works of man, in company with those of extinct animals, to which discoveries the important work of SIR CHARLES LYELL, on the "Antiquity of Man," has now set the seal of recognition, the question of these caves and their strangely associated contents has become one which opens to us a novel and most fascinating field of enquiry. Already great advances have been made in opening up this question, and the vigour with which it is being prosecuted promises 'ere long to lift the veil of obscurity which has so long shrouded this class of facts.

It unfortunately happens that these caverns at Banwell, and elsewhere, have been opened at a time and under circumstances which have precluded a fair and impartial examination of the conditions under which the osseous remains were accumulated within their recesses. The theory that all such evidences were referrible to a "deluge" that took place some 4 or 5,000 years ago, which found the predaceous animals whose remains are there preserved, inhabiting these fissures as dens, and conveying thither as prey those others whose bones are entombed with them, obtained such universal acceptance, that nobody presumed to doubt the fitness of the explanation to meet all the difficulties of the case; while as regards the discovery of human remains, the theory of "burial" at once satisfied all the requirements of the case, and conveniently dispensed with further enquiry.

Thus it happens that the presence of animal remains in the Banwell Caverns was at once referred to the causes above-mentioned; and as a natural consequence of this method of reasoning, the exploration of the contents of the cave was not conducted upon any systematic principles. Everything there now appears to have been so much disturbed by human agency that little reliance can be placed upon present appearances. Enough, however, still remains to guide the observer to certain facts and conclusions. In the first place there are distinct marks of water-action upon the roof and sides of the cavern, which tell unmistakeably of the passage of a powerful current of water through the fissure during a lengthened period of time. Secondly, the cave has been filled from floor to roof with a mass of angular and subangular fragments of rock compacted in a muddy paste, throughout which the bones and teeth of quadrupeds are found, not in layers, as might be expected to be the case, had the cavern been used as a den, the floors of which were gradually raised, but strewn as it were broadcast throughout

the entire deposit. It is observable that these bones exhibit no appearance of being rolled. There is therefore no reason to associate the marks of water-action on the roof and sides, with the date of the in-filling of the bones and angular fragments. Moreover, it is clear that so long as the water had force to propel the stony fragments, no layer of mud could accumulate. But that a change at length took place is certain, probably in consequence of some convulsion by which the drainage of that district was altered, and the waters which had used that channel were diverted, except perhaps at particular periods of overflow, when fissures now closed may have given access through infiltration from neighbouring caverns—possibly the resort of *carnivora*—to the gravel and bones which we now find

“ Confus’dly hurled,

The relics of a former world,”

in such profusion, and in such a remarkable state of preservation, in the Banwell Caves.

Thursday, 19th of June, was occupied in an excursion to Wells Cathedral and Glastonbury Abbey. The geologists afterwards ascended the Tor Hill, at Glastonbury, examining by the way the structure of this commanding elevation, which, in common with many other eminences, rising abruptly out of the flat levels of Somersetshire, remain to show the eroding effects of water-action over a vast thickness of beds, of which these out-liers are now the only evidences. The following “Notes upon the Geology of the Tor Hill, near Glastonbury,” were supplied to me by EDWARD HARTSWICK DAY, Esq., F.G.S.

“The height of this hill may be roughly estimated at about 500 feet. Our knowledge of the geology of its lower portion is obscure, there being no quarries or natural sections to lay bare its strata. Whether the beds of the Keuper enter at all into its structure, or whether as at Street, they underlie the surface of the surrounding valley, I cannot say, since the lowest beds that I have been able to notice are some of the Limestones of the ‘*Bucklandi-zone*’ of the Lower Lias. These occur in a quarry on the north side of the hill, at about 90 feet over the level of the valley at the Brick-Kilns. I cannot, however, say to what portion of the Lias series these beds belong.

“A little above the quarry mentioned, I found sands belonging to the Middle Lias, but I am by no means sure that they are in their original position; on the contrary, I am inclined to think that they have slipped from a higher level. The junction of the Lower with the Middle Lias is therefore totally concealed. In the lane leading from the town to the Tor, a section is obtained of a portion of the Middle Lias Sands; and in the quarries on Stone Down, we find these sands capped by two beds of Marlstone, 4 feet in thickness. These in turn are covered by the Upper Lias clays and

ragstones, of which I have seen 13 feet exposed without arriving at their junction with the sands above. From these quarries to the summit of the hill is somewhere about 180 feet, the greater part of which is composed of the Upper Lias Sands, with indurated bands and layers of sandy nodules.

"Of the inferior Oolite Limestones which would, if present, rest upon these sands, I have seen no trace in this hill. Were they represented, their hard masses would assuredly be conspicuous upon the face of the very steep incline. I have never, however, found even a single displaced block nor an Inferior Oolite Fossil on the sides of, or beneath the hill. The Inferior Oolite may possibly be there for all that; I can only say that I have not been able to find it.

"The following lists of fossils, though very small, are sufficient to identify the Marlstone and the Upper Lias respectively:—

FROM 'THE MARLSTONE.'	FROM 'THE UPPER LIAS.'
<i>Ammonites margaritatus</i> ,	<i>Ammonites communis</i> ,
<i>Belemnites irregularis</i> ,	———— <i>crassus</i> ,
<i>Pecten æquivalvis</i> ,	———— <i>Raquinianus</i> ,
<i>Terebratula cornuta</i> ,	———— <i>bifrons</i> ,
———— <i>resupinata</i> ,	———— <i>serpentinus</i> ,
———— <i>punctata</i> ,	———— <i>radians</i> ,
———— <i>Moorei</i> ,	<i>Belemnites tricanaliculatus</i> ,
<i>Rhynchonella tetrahedra</i> ,	<i>Terebratula Lycetti</i> ,
———— <i>acuta</i> ,	———— <i>pygmæa</i> ,
Species of <i>Myacites</i> , <i>Lima</i> ,	<i>Rhynchonella Moorei</i> ,
<i>Avicula</i> , and other genera,	<i>Rhynchonella Bouchardii</i> .
occur, all recognisable as	
Middle Lias forms.	

"N.B.—*Ammonites spinosus* and *Rhynchonella furcillata* occurred to me also in these beds, but on fragments of stone evidently derived from the Middle Lias."

Wednesday, 23rd of July. The Club met at the Frocester Station, and proceeded over Frocester Hill, by way of Uleybury, Longdown, and Peak-down, to Dursley, examining by the way the succession of beds met with in the ascent of Frocester Hill, attention being more particularly directed to the *Cephalopoda-bed*, which has been so thoroughly explored, and its contents noted by Dr. LYCETT. The examination of this bed was greatly facilitated by the labours of workmen employed under the direction of Mr. WITCHELL, to clear away the rubble and expose the Ammonite-bed, which yielded to the hammers of the party a good suite of characteristic fossils. At the summit of the hill, attention was attracted to the striking example of oblique lamination, which is there presented. The upper beds, perfectly horizontal, are here seen to rest upon others in all respects perfectly homo-

geneous, but inclined at a very considerable angle, the line of juncture between the two being exactly parallel to the upper and undisturbed beds. No satisfactory explanation has yet been offered of the remarkable phenomena of "oblique lamination," or "false bedding." Mr. HULLS, in his notice of the geology of the country round Cheltenham, makes mention of the subject, but without supplying any key to the solution of the difficulty. This is a subject which would well repay investigation, and it is one which can only be cleared up by a careful comparison of facts accumulated over a large area, and observed with an eye to minute particulars, having regard more especially to the phenomena of cleavage planes and ocean currents, to the influence of both of which agencies, but more especially to the former, this very puzzling arrangement of beds is probably referable.

Near Uleybury, the Club visited the remarkable "tumulus," which was opened in 1821, and again in 1854,—the chambered interior of which still remains in a good state of preservation. A carefully-drawn account of the facts attending the examination of the tumulus on both the occasions referred to, has been published by Dr. THURNAM, in the 11th Vol. of the *Archæological Journal*. He has likewise treated the subject of the human remains found in the barrow, in the first Decade of *Crania Britannica*. The examination of this ancient place of burial caused attention to be drawn to a similar mound, said to be on the eve of demolition, being deemed an obstruction, situated at the distance of a mile or so, near the village of Nympsfield—and the interest of the audience being further stimulated by a report that a partial irruption had already been made into the mound by rude bores in quest of stone, and that some bones had been discovered—it was resolved that immediate steps should be taken for obtaining the consent of the proprietor to a systematic examination of the tumulus, by a committee of the Club, who should be instructed to make a careful report of the result of their labours. Accordingly a committee was named, which afterwards met on the 30th of August, and completed the task assigned to them, entrusting to PROFESSOR BUCKMAN the duty of drawing up a report of their proceedings, which will hereafter appear in the published records of the Club.

The Club dined together at the Bell Inn, Dursley. After dinner a paper was read by the secretary, from Dr. LYCETT, of Scarboro', on some Ammonites of the district, which was followed by another on "The distribution of the land, fluviatile, and lucustrine Mollusca of the County," by Mr. JOHN JONES.

Wednesday, 20th August. The Club met at the Kemble Station on the line of the Great Western Railway. The examination of the interesting "Fault" between that point and the tunnel, gave occupation to the

geologists, to many of whom the position was a new one; and as the point in question is a good example of those "shakes" and "dislocations" of such frequent occurrence throughout the Cotteswold district, the examination of the beds on both sides of the line of fracture occupied the eyes and hammers of the party for some time. At this point the "Great Oolite" is seen on a level with the overlying "Forest Marble" and "Cornbrash," indicating a "down-throw" of considerable magnitude. A good suite of fossils were here collected, principally from the "Cornbrash," which yielded—

<i>Terebratula obovata,</i>	<i>Myacites securiformis,</i>
———— <i>maxillata,</i>	<i>Lima duplicata,</i>
<i>Avicula echinata,</i>	<i>Echinobrissus clunicularis,</i>
<i>Gresslya peregrina,</i>	<i>Clypeus Plotii.</i>

From hence a walk down the line of railway to the Tetbury-road station, afforded the party an opportunity of examining the small but well-characterised patch of "Bradford Clay," which is exhibited at that point in the road-cutting between the station and the small roadside inn close by. This uppermost member of the Great Oolite series is but sparingly developed in any part of the Cotteswolds; indeed I know of no other locality in the district where so good a suite of its distinctive fossils may be obtained. The following were collected by the club, and noted upon the present occasion:—

Terebratula digona,
Rhynchonella coarctata,
 ————— *cardium,*
Claw of a crustacean,
Fragments of Urchins.

From the Tetbury-road station the party proceeded to visit the ancient entrenchment in the parish of Cotes, known as Trewsbury Castle—a position as it would seem of some importance, judging from its extent—which comprises within its area a space of some eighteen acres. It appears difficult at this time of day to assign an object for a detached camp of such extent within so short a distance of the great military station of *Corinium*. That it was occupied by the Romans does not seem to admit of a doubt, as coins of that people have been found on the site; and during the visit of the Club a well-sinking had revealed portions of pottery of a coarse description, to which the antiquaries of the party unhesitatingly assigned a Roman origin.

The Club was met at this point by the proprietor of the demeane, upon which Trewsbury stands, Mr. DEWE, who most courteously invited the party to partake of refreshment at his residence; a proposal which met

with very ready acceptance. It was found, however, that this refectory interlude occupied so much time, that the delay rendered impracticable the prosecution of that portion of the programme of the day's work, which embraced a visit to Sapperton Tunnel and Hailey Wood, and it was deemed advisable to proceed direct to Cirencester. Here a visit was paid to the Museum of the Royal Agricultural College, to that of Roman Antiquities adjoining Lord Bathurst's Park, and to the so-called "Bull-ring," at the Querns, which PROFESSOR BUCKMAN regards as the site of the Roman Amphitheatre.

The party dined at the Ram Inn, about 26 in number. In the absence of the secretary, the vice-chair was occupied by PROFESSOR BUCKMAN. After dinner PROFESSOR BUCKMAN introduced to the notice of the Club specimens of *Cnicus tuberosus*, grown from plants of *C. acaulis*, discovered by the Professor, at Avebury Circle, Wilts, and transferred by him to a richer soil—showing in a most interesting manner how the one form, few-flowered, stemless, and with simple roots, changes by cultivation into the tall, many-flowered, and tuberous-rooting form of *C. tuberosus*.

These experiments show the genus to be highly capable of variation, and hence in all probability much confusion has arisen in regard to nomenclature, a point which after all, experiments alone can settle.

MAJOR BARNARD exhibited examples of a *Pyrus*, new to our county, and indeed, as it would seem, to England generally,—*Pyrus fennica*, of Babington, to which that distinguished authority assigns "Mountains in the Northern part of the Isle of Arran," as the only known British locality.

The discovery of these plants in our neighbourhood is a circumstance of great interest to botanists, and reflects credit upon the acuteness and intelligence of our associate.

An interesting discussion ensued upon the sudden and inexplicable appearance of new and strange plants, on newly cleared ground, of which curious instances were mentioned by Mr. NORWOOD, the president, and others. It is probable that carefully collected observations on this class of facts would prove of value by throwing light upon the obscure and hitherto unexplained circumstances connected with the origin and distribution of plant life.

Before separating it was resolved that an extra meet of the Club should be held at Cheltenham, in September. Accordingly, on Wednesday, 24th of that month, the final meeting of the Club for the season took place at the Queen's Hotel, Cheltenham, from whence the party, accompanied by many lady-visitors, proceeded to Sudeley Castle, near Winchcomb, the residence of Mr. and Mrs. DENT. A halt took place by the

way near the summit of Cleeve Hill, to allow of an examination of the "Road-stone" quarries, where Dr. WRIGHT gave to the assembled company a brief but lucid description of the very interesting beds opened up at this point, which, with their peculiar organic contents, are of especial interest to the geologist, as at no other locality throughout the Cotteswold district is the "Middle" or "*Humphresianus zone*" of the Inferior Oolite equally well displayed. This section was made a special subject for elucidation by the Cotteswold Club two years ago, when it was thoroughly worked out by Dr. WRIGHT, and Messrs. JONES and NORWOOD.

From hence the excursionists proceeded direct to Sudeley Castle, where they met with a most hospitable reception from Mr. and Mrs. DENT, who had most considerately provided luncheon for their visitors.

The dinner, which took place at the Queen's Hotel, was well attended, both by gentlemen and ladies; amongst the latter the presence of the distinguished authoress of the *Queens of England* must not be overlooked.

After dinner a paper was read by PROFESSOR BUCKMAN, on the "Ennobling of Wild Plants," and some observations by Dr. BIRD upon the "Tumulus," lately opened by the Club, at Nympsfield, gave rise to an animated discussion, embracing the question of pre-historic evidences, and the probable duration of man upon the earth during periods of time far exceeding those to which some computations would limit his existence. The subject was debated in all its aspects by different speakers, the Rev. W. S. SYMONDS, Dr. WRIGHT, Mr. D. NASH, and the Rev. Mr. NORWOOD, taking a prominent part in the discussion, which seemed at last to favor the ante-dating of humanity, though whether to the extent of "*myriads of years*" as one gentleman contended, seemed hardly to be conceded.

With the account of this meeting terminate the records of the transactions of the Club during the year 1862,—a season distinguished among many others by the large amount of energy displayed by the Club in the pursuit of all those branches of science which come within the range of its cognisance,—an energy which, well applied and judiciously directed, cannot fail of securing for us, as a scientific body, that place and consideration which we have striven to obtain. But further, I believe, that by persistence in such a course of action, we shall best accomplish a primary object of our association,—that of fostering a love of natural science amongst those who come within the circuit of our influence, and of holding out a helping hand to younger students of nature, who should be led to group themselves around us—as around a nucleus—which offers to them at the same time a position as naturalists, and the society of those who are well qualified to lead and instruct them in those delightful paths

of enquiry which have been to us such a fruitful source of happiness.

In conclusion, let me beg of you to accept my warm thanks for that support which you have so cordially and so continuously given to me. To *that* support, aided by the valuable co-operation of your secretary, am I enabled to attribute any measure of success which may have attended my endeavours to administer the affairs of a body of gentlemen, which numbers amongst its members so many distinguished for eminent attainments and scientific reputation, as, I am proud to say, are enrolled on the records of the COTTESWOLD CLUB.

On the Natural History, Geology, &c., of Sharpness Point District. By
 JOHN JONES. *Read at the Cheltenham Meeting, 1863.*

How little is popularly known of the river to which the second rank in England is universally accorded, may be inferred from the fact, that in a novel by a writer of deserved repute, published, let us say, within the last ten years, a gentleman is made to take up his fishing rod and to throw a fly on the Severn, in the immediate neighbourhood of Bristol, without, so far as we have observed, attracting the notice of the professional critics, by whom the work in question has been reviewed.

It may be, that the author himself performed an experiment, *sui generis*, and was fortunate enough to realize his expectations; but we feel confident that no other individual would think of fly-fishing, in water of about the colour, and nearly the consistency, of pea-soup. In truth, we believe, that with the exception of those persons who win their bread from its waters, few of the dwellers upon its shores, in the lower part of its course, care to know more of it than is revealed to them in the immediate vicinity of their own homes. No steamers laden with pleasure- or lucre-seeking passengers ply upon it, above the mouths of the Bristol Avon and the Wye. The low-lying shores of its Estuary, consisting of dead levels of alluvium, through which it flows for many miles, possess no scenic attractions which can bear the briefest comparison, with those of its above named tributaries; its turbid waters are therefore frequented only by the wanderers who navigate the craft, which since the opening of the Gloucester and Berkeley canal, in the year 1827, have brought supplies of cereals, timber, and other merchandize, for the populous districts of the Midland Counties.

The few and transitory glimpses of it, obtainable from the South Wales Railway, are eminently unsatisfactory. On the ebbing or flowing tide, a few scattered sails, or the dark smoke of a steam-tug may arrest the eye; and at low water, a few fishermen, armed with hand-nets, may be seen wading slowly, or standing perfectly still, in the 'pools' left here and there in the sad expanse of sandy mud or muddy sand, conveying the idea of beings, fated to abandon all human habits and instincts, and to adopt those of the patient but ever hungry heron.

Although this unflattering description is not likely to attract the attention of the ordinary tourist, yet we do not despair of convincing

the Geologist and Natural Historian that he may as well, and worthily, spend a few days in this portion of Sabrina's domain, as in many other localities whose charms are superficially more apparent. By the way, the mention, or rather indication, of the existence of meretricious beauty in connection with the name of *Sabrina*, brings to mind a difficulty in reconciling the very opposite idea represented by the Celtic word from which her Latin name appears to have been euphonized, with that which the readers of Milton, are accustomed upon his showing, to attach to it. He tells us in *Comus*:—

"There is a gentle nymph not far from hence
That with moist curb sways the smooth Severn stream,
Sabrina is her name, a virgin pure
* * * * *

The guiltless damsel, flying the mad pursuit
Of her enraged stepdame, Guendolen,
Commended her fair innocence to the flood,
That staid her flight with his cross-flowing course."

The statement that she thereupon became goddess of the river ; the description of her reception by the water-nymphs, of the offerings made to her by the shepherds, who

"Threw sweet garland wreaths into her stream
Of pansies, pinks, and gaudy daffodils."

The purpose for which her aid was invoked, and the song in which this is formally done by the attendant spirit, beginning,

"Sabrina, fair,
Listen where thou art sitting,
Under the glassy, cool, translucent wave,
In twisted braids of lilies knitting,
The loose train of thy amber-dropping hair :
Listen, for dear *honour's* sake,
Goddess of the silver lake,
Listen and save,"

teach us unmistakeably, that the scene of her death was popularly believed to have taken place in the upper and pellucid portion of the stream ; that her Latin name was almost synonymous with virgin purity and honour.

Strange to say, the Celtic appellation, *Hafren*, bears a signification of the most opposite and degrading character ; the last in fact that should be deemed appropriate to any female. Philology alone, we fear, will not enable us to account for the difference in meaning, of words avowedly identical in derivation. Can it be, that as the river changed in character from the crystal stream, to the muddy tide fare, so did the

meaning attached to its primitive designation ; or did the inhabitants of the Southern parts of Wales, who still sometimes exchange uncomplimentary epithets with their Northern neighbours, spitefully or contemptuously adopt a name held in honour by their hereditary foes or rivals as one of infamy amongst themselves ? *

The ventilation of this question might, perhaps, elicit some of that curious information, or of those ingenious hypotheses which find a genial home in the pages of "Notes and Queries."

The names of places and persons in the districts dominated by the Romans, composed of Celtic elements, appear to have been generally euphonized by them, and adopted into their language.

We cannot doubt, that in the case under consideration, the honours of deification, and the legend or myth attached to the name of Sabrina were of Roman origin, and the principles upon which the word "Hafren" has been converted into "Sabrina," admit of exemplification from so many languages and their dialectic changes, as to become perfectly intelligible. The Latin tongue having no sound equivalent to that of the hard Welsh "uch," by the process of adaptation of sounds to the power of vocal enunciation, which becomes in the lapse of time characteristic of races, and may be traced through many other languages, has substituted for it the softer sound of S.

Without going more deeply into the subject of dialectic variations, it will suffice to be reminded how constantly and systematically such changes are adopted, even by people of cognate origin. The transition of P, F, or V, into B and P, is common to too many languages and dialects, to require more than a passing reference. In point of fact, the difference of pronunciation, as regards either letter, is little greater than that upon which the lives of a race once hung in the word "Shibboleth."

The Saxons, in all probability, adopted Romano-British words for incorporation into their own language in like manner. Ignoring the myth, they felt that, by the natural change of B into V, the name would be not only significant, but appropriate, and Sabrina, the nymph, became Sæferan, by elision Sæfren, from 'Sæ feran,' Anglo-Saxon, *to go to the sea*, "the *sea fare* or *way*," by which name it is still known, preserving amongst the people of the district, through all the changes of language which have since taken place, its ancient pronunciation.

Few words, could more succinctly prove the correctness of the principle, upon which we may suppose the later appellation to have been formed, or which enables us more truly to trace derivations of others, exhibiting similar peculiarities, from languages as distinct

from each other as are the significations necessarily attached to their elements.

Thus we see that the name, Hafren, presuming it to be derived from the same root as from the Celtic verb, "Hafru," "to render sluggish," is sufficiently appropriate to the river, in that part of its course which must always have been of the greatest social importance, * as from Worcester to Kingroad no greater fall than of about 4 inches in a mile takes place.

The Latin name, to possess any meaning at all, must be derived from a common root with *sabulum*, and *saburra*, "sand, or fine gravel," and, in testimony of its perfect applicability in this sense, to a river more charged with sediment than any other in Europe, we need only cite Shakespeare, who, in his King Henry IV., calls it "the sandy-bottomed Severn."

Upon the Anglo-Saxon appellation, we have already sufficiently expatiated; and, if in despite of the fanciful vagaries of some of the admirers of philology, we have been able faintly to illustrate her value, as a hand-maiden of history, we willingly incur the risk of being considered somewhat prolix, in the hope of showing, in the present instance, how notes, evoked apparently at random from various strings, may be made to combine in one harmonious chord.

The compiler of the History, attributed to Nennius, names the "*Duo Rig Hafren*," the two kings of Severn, as amongst the wonders of Britain, representing the conflict between the ebbing and the flowing tide, to which the Saxons gave the name of 'Hygre' or 'Egor,' the equivalent of the Latin *Æquor*, or the 'flood,' of the various Scandinavian and Teutonic dialects, the latter being the term generally applied to the phenomenon at the present day, 'Eager' and 'Hygre' being nearly obsolete.

Thomas Carlyle derives the term from the name of a Iotun or giant, who was the personified spirit of Sea Tempest, but he does not state where, in old Norse literature, traces of the supposed existence of such a semi-deified power may be found. Another term which is also frequently used for it—*Bore*—is clearly traceable to the Saxon word, "*Beran*," to bear or carry, from the facilities which it lent to the transit of merchandize, and for the purposes of ordinary social intercourse.

The district to which we shall chiefly direct attention at present, is that which lies between Sharpness Point and the Hock Crib, at

* "Sed tamen duo flumina, præclariora ceteris fluminibus, Tamesis ac Sabrina, quasi duo brachia Britanniae, per quæ olim rates, vehebantur ad portando divitiarum, pro causa negotiationis."—*Nennius*.

Fretherne, (the "Scearp-Nesse," "Acute Promontory," and the "Hock Crib," or "curved lying place") comprising the "New Grounds," so called from their having been formed, and reclaimed from the Severn, at a very recent period.

Our object in recording the following observations is to show how many of the objects, which excite our curiosity and enthusiasm, during hurried voyages on Highland lochs or Norwegian fiords, submit themselves to investigation in our immediate neighbourhood, we therefore, invite our audience to accompany us in a day's ramble over the tract in question.

We embark at 7 a.m., at Gloucester, in the steamer, *Wave*, on a glorious morning in August, and, after breakfasting on board with her intelligent Captain, Mr. Calway, land at Sharpness about 9.50, in time to witness the entrance of two or three fine ships from America and the Black Sea, with several smaller vessels from less remote shores, and admire the remarkable skill with which they are handled by the dock-master, pilots, and their crews, in the narrow entrance to the port.

Taking advantage of the momentary closing of the swing bridge over the outer lock, we pass into the gardens of Lord Fitzhardinge, to which he so liberally grants access, selecting a seat which commands the best view of the river channel towards Kingroad, and watch with equal interest the departure of a motley fleet of vessels, composed of French luggers, Dutch galliots, an Austrian polacca, and smaller craft, for various ports of the Bristol Channel, to take in the cargoes with which Gloucester as yet, is not in a position to furnish them; casting a longing glance at Aust Cliff in the distance, with thoughts of its celebrated bone beds, as the vessels recede rapidly from us upon the falling tide, we re-cross the canal entrance and prepare for the return journey, leaving Sharpness Point at about 11 o'clock. Now, commencing the business of the day, we do not proceed far, before we have the satisfaction of knowing, that we have completely mystified a small group of anglers, seated upon a timber raft on the opposite side of the canal, by baring an arm and taking a stone or two from the water, for the purpose of satisfying ourselves that our old friends, *Neritina* and *Ancylus fluviatilis* and *Dreissena polymorpha*, (which occur here in great number and of large size,) are well, and carrying away a few to supply "the ripe wants of a friend." This done, we proceed towards Purton, plucking from the canal bank here and there, a handful of moss for examination by the way.

Upon most occasions, we have had no difficulty in adding to our collection, specimens of *Zua lubrica*, *Azeca tridens*, and two species of *Vertigo*, but on the present, from the dryness of the season, we are unsuc-

cessful. From the same cause, the fine, highly coloured lichens which cover the sea wall, have lost their attractions.

Crossing the wooden bridge, over the sluice which allows the waste waters of the canal to escape, we approach the place at which the ferry boat from Pyrton on the opposite side lands its passengers, the names of both being probably derived from the same Anglo Saxon elements of *Per-tún*, "the dwelling on the pier," and evidencing the antiquity of the ferry, the rights pertaining to which are still strictly enforced by the lessee.

An interesting chapter in practical Geology may be read by the initiated from this spot.

We stand nearly upon the summit of the protruded Silurian dome, represented in a coloured section, published in the first edition of Murchison's "*Silurian system*," and may find in abundance under our feet, characteristic shells, and corals of the upper Ludlow beds, though much damaged by the action of the tidal waters. The colour of this rock differs so little from that of the Old Red Sandstone beds which once rested immediately upon it, and still flank it, that the precise point of contact is difficult to discover.

Upon the opposite shore, full in our view, are the Old Red Sandstone Rocks which form the upturned edges of the Forest of Dean coal basin, the equivalents of the cornstones, and show at a glance, by the well marked anticlinal lines of their strata, dipping from one point towards Lydney, and from another towards Gloucester, the wave-like character of the motion of the subjacent beds, by which their elevation, with that of the Silurian Rock, just mentioned, was effected, and their curvatures produced. The transverse section, showing how this last passes under the others, appears to us to be of equal interest to the published section, and we have here ventured to produce it, from such observations as the constantly changing bed of the river has enabled us to make; remarking that from the inaccessibility of the former, the club would confer a boon upon its members by re-publishing it.

Walking along under the cliff, towards the Berkeley Arms Inn, from the seat, in front of which, the finest view of the district, to be seen from the river, may be obtained, we arrive at the mass of Old Red Sandstone, anticlinal to that over which we have just passed, upon which the house stands, although, from the amount of silt deposited within the last ten or twelve years, the point of junction is obscured; and crossing the road leading to the Pier, we come at once to the lias beds, which form the well-known Purton section, reposing unconformably upon the same. Some forty years since, the principal channel ran under this cliff, but, from the

operation of the breakwater commenced by the late Earl Fitzhardinge, land is rapidly forming here, and the current has been diverted to the Forest of Dean side. The alluvial deposit behind the breakwater, in the direction of our course, from its yet unstable character, renders it difficult to trace the liassic beds from their immediate line of contact with the Devonian : but at the distance of about half a mile from the Inn, they become accessible, and, notwithstanding many slips of the soil, allow their strata to be tabulated, from highwater mark, in the following ascending order :

Stiff and somewhat laminated clays, containing young <i>Ammonites</i> , an occasional <i>Belemnite</i> , <i>Spirifer Waleottii</i> , the <i>Gryphaea incurva</i> in all its varieties	2 to 3 ft.
Limestone band, containing <i>Nautilus</i> , <i>Am. Conybeari</i> , <i>Rhynchonella</i> , <i>Spirifer</i> , <i>Lima</i> , <i>Pecten</i> , <i>Modiola</i> , &c.	10 inches
Distinctly laminated clays, which become lighter in colour upwards	12 to 14 ft.
Limestone band	8 to 10 in.
Stiff blue clay, varying in thickness, upon which repose oolitic gravel and vegetable soil	;

Few scenes can more vividly impress themselves upon the mind of a young geologist, than that which presents itself here, after a fall of the rock, and its exposure for a few weeks to the tidal and atmospheric action. The beach is sometimes strewn with the fossils of which a list is subjoined, in the finest possible condition, more especially as regards Gryphites, which are found of every type conceivable within the limits of one species ; and that one only exists here, the writer has endeavoured to prove in a former paper, now forming a part of the Transactions of the Cotteswold Naturalists' Club.

Next in order, as regards number and state of preservation, come the *Ammonites* and *Nautili*, some of which are of very large dimensions. A portion of a *Nautilus*, which must have been at least eighteen inches in diameter, is now lying before us, and *Am. obtusus* of not inferior size. The smaller fossils may easily be separated from their stony matrix with a light hammer and small chisel, but the only safe mode of proceeding with such specimens as those above-named, is to expose to the alternate action of tide and frost, the blocks in which they lie embedded, by which method some of the best specimens known from this locality have been obtained. From the fact of the chambers of the larger *Nautili* and *Belemnites* being either partially hollow, or filled with crystals of carbonate of lime, combined with the extremely brittle character of the coating of petrified shelly matter which covers, and separates them, the blow of a hammer, however skilfully applied, almost invariably fractures them irreparably.

Those curious concretions to which no English name has yet been

given, but which the Germans call "Nagel-Kalk," are found here in great numbers, varying in size from that of a small belemnite, to that of a man's head, or even larger.

No difference in the texture of the stone of the separate portions can be distinguished by the eye, yet we know that there must be a sufficient cause for their being so acted upon by exposure to the atmosphere. We are not acquainted with any theory as to their origin or nature, and therefore wonder what they might have been. We observe that organic remains, such as the fragment of an encrinite, or a broken shell, is more frequently imbedded in the central, than in the outer portion, of such as we meet with, and the question suggests itself—can they have been sponges, buried in the thin band of fine mudstone in which they occur? If so, there is an indefinable kind of consolation in the thought, that though the body have entirely perished, the fact of the Divine gift of life having once pervaded this apparently purposeless concretion, has left its own testimony in the partial outlines here exhibited.

We have obtained from the beds described the following fossils :—

Belemnites

Ammonites Conybeari

——— *obtusius*

Nautilus lineatus

Gryphæa incurva, with all its varieties

Ostrea, covering the larger Ammonites, in great perfection, of large size, and covered again themselves by *Serpulæ* and *Placunopses*

Pecten, two species

Lima gigantea

——— *var. minima*

——— *punctata*

——— *antiqua*

Cardinia

Unicardium cardioides

Spirifer Wallcottii

Terebratula numismalis

Rhynchonella variabilis

And several small *Cerithiform univalves*

We have now arrived at the end of the cliff near the second breakwater. Higher up the vale of Gloucester, it is difficult to obtain a clear idea of the correlation of the vast beds of gravel composed of the detritus of the liassic and oolitic beds of the neighbouring hills, containing elephant and hippopotamus remains, occasional chalk-flints, &c., with what is popularly known as the *Northern Drift*, (but to which appellation, we conceive that there are substantial reasons for objecting.) Be that as it may, the order of superposition is well shown, in a small excavation within a few yards of the breakwater upon the edge of the cliff, where a bed of the gravel above-mentioned has been worked to a small extent.

Upon the gravel rest two or three feet of vegetable soil, over which is strewn another bed of similar gravel, an inch or two only in thickness, and over all, under the existing herbage, the quartzose and red sandstone pebbles, of the (so-called) northern drift. Taking our stand at this point, and scanning the vale with the eye of a geologist, we may readily trace the sequence of all the deposits, of which the elements of the landscape around us consist. We cannot doubt that the lias upon which we stand, once stretched across what is now the channel of the Severn, and rested upon the red sandstone, as corresponding beds do at present on the opposite shore at Awre, near Poulton Court. Looking directly up the river, we may see distinctly, with the aid of a glass, the same beds stretching away in a corresponding direction at the Hock Crib, and we know that a few miles beyond this lies Westbury Cliff, where the lowest beds of the lias rest upon the new red marls, and these, at Flaxley, unconformably against the Upper Silurian rock, thrown up near Sir Martin Crawley's schools, enabling us to judge at what period the great disturbance of the Protozoic formations in this neighbourhood took place.

All these, from the Mayhill sandstone to the upper beds of the Carboniferous system, had been placidly deposited in their due order in the depths of a vast sea.

The section of the Forest Coal Field, in any direction, shown upon the maps of the Geological Survey, indicates no relative disturbance of its component strata, prior to that effected by the turning up of its edges, by the protusion of older rocks which form the tracts, which separate it from the neighbouring coal-fields of Bristol and Glamorgan, the central portion remaining comparatively undisturbed. The relations of the Secondary, to the Protozoic and eruptive rocks of the district, are everywhere the same, and the line of unconformity between them, may be traced from the trap boss at Tortworth, behind us, on the S.E., to the flanks of the Malvern range, before us, on the N.W. Wherever first or last exerted, we know that the cosmic force by which that great Sienitic mass was abruptly uplifted, produced the contortions of the Silurian rocks around it, and the undulations of those before us, and under our feet; passing hence, still upheaving Silurian strata through those of the Devonian age, and penetrating these again at Tortworth with a mass of trap, it subsides from this point under the Bristol coal-field to produce effects analogous to those already described around and beyond it. It is not our object to trace further the development of this force, and its consequences, but to bring more prominently forward than they have hitherto been brought in the Transactions of the Club, those

geological features, easily accessible at many points in this county, by which we ascertain, approximatively, the period at which these commotions, to which we at present owe the diversity of its soil, and scenery, and access to its mineral wealth, took place. In and around the Forest we have precipitous escarpments of Carboniferous limestone and shales, with those of older rocks, in such position as to prove how great must have been the extent of their detritus, carried away, we know not whither. As the ancient detritic material of the lowest and most compact strata—which would necessarily be the most recent, as the last exposed to aqueous action—has left no trace of its existence here, we may not reasonably expect to discover any debris of the higher strata which once reposed upon these.

We have no traces in the Forest area, for example, of the Magnesian Limestone, and its associated beds, which in other parts of England, and upon the continent, follow in regular series those of the Carboniferous system; yet we find at Bristol a Magnesian conglomerate, with the remains of undoubted Permian reptiles, and as we cannot believe, from the sharp angles of the rock fragments of which it is composed, that they have travelled any considerable distance, we must necessarily suppose that the formation, of which it is the representative, *was* to some extent developed here.

We have seen the upper beds of the New Red Sandstone, deposited unconformably against the upthrown Silurian and the Old Red, at Flaxley and elsewhere; the Lias against the Old Red Sandstone as here; and upon Silurian strata, as near Eastwood; Mr. CHARLES MOORE has informed us that the fissures of the Carboniferous Limestone of his district contain liassic fossils; and Mr. ETHEREDGE has shown us a specimen of the same limestone bored by *Lithophagidæ*, at whose death, their holes were filled up by then forming oolitic granules.

Under these circumstances, as we are not acquainted with any group of strata intermediate to the Permian and Triassic formations; and as we do not find these in contact here, may we not reasonably infer, that beds of Permian age *had* been deposited here in their due sequence; but having been swept away, either prior to, or in consequence of, their disruption by the disturbances indicated, when the deposition of the Triassic formation commenced, the forms of life which characterized them are here wanting, and the Mesozoic, which characterize the next vast epoch, assumed their places.

Truly, if a man have a devotional spirit within him, and can appreciate the immensity of the gulf into which he gazes, and which he is enabled to bridge over, by the exercise of that gift of intellect which

distinguishes him from all other created beings, here is a fitting place for its silent outpouring.

We hold in our hand a tide-worn portion of one of the stone lilies which, in the words of Edwin Forbes, "waved wilfully its graceful stem," in the Silurian sea, at a time so remote from that represented by the ancient stratum upon which we are standing, as to perplex the imagination in any attempt to realize a comparative idea of the lapse of cycles between them, or of those required either for the pre-existent, or subsequent development of the earth's crust. At our feet lies the crushed shell of a large ammonite, covered with the separated star-like joints of the Lias Pentacrinite, not uncommon here, seeming to suggest, by its agreement in general design with the Divine idea manifested in the older form, that the all-pervading intelligence, infinite and eternal, is, indeed, unmindful of nothing that it *has* made.

A glance at the great lias outlier of Robinswood Hill, looming up from the centre of the vale, reminds us that since the changes we have contemplated, others as remarkable have taken place: for we recollect that this must once have been conterminous and continuous with the liassic slopes of the Cotteswolds, which form the back ground of the landscape, and flank it on the right. These, we know, are merely capped by beds of the Inferior Oolite, the detritus and fossils of which, mingled with those of the lias, strew the valley from beyond Eveaham, to the quarry on the cliff which we have already visited, evidencing action to which they have been subjected, by which the deep combs and bays, which indent them, have been formed. The recent origin of the gravels is apparent from the remains of the great extinct pachyderms still found amongst them, and occasionally the shells of Mollusca still existing around us.

We have expressed some doubt as to the origin of the Drift which overlies these gravels, to which the epithet "Northern" has been expressly applied, because, the further we travel south-westward, the heavier and larger do we find the pebbles, which constitute it, become; and we may reasonably suppose, that the smaller detritus wanders furthest from its parent rock. There may, indeed, have been an influx of similar material at the other end of the valley, but from its sparsely scattered condition, and the minuteness of the fragments, of which it is here composed, we feel rather disposed to ascribe to it a south-westerly than a northern origin.

As compared with these drifts, the Severn Channel is of modern formation, for we see at this point that its bed is worn through them and their underlying gravels, a circumstance, which the want of coherence, and difference in the rock materials here in juxtaposition, must have much favoured.

Another feature of great interest in this district, to which our attention was first called by Mr. CLEGRAM, is the existence of an extensive bed of peat, in which are found trunks and roots of trees, principally oak, in the ordinary state of what is popularly known as Bog-oak. These may be best seen on the sides and in the bed of the watercourse called the Royal Drough, in the excavation of which they were first brought to light. They are accompanied by the catkins of hazel, and the leaves of waterflags and other plants, which show that they could not have been transported far from the place in which they grew. The thickness of the peat-bed is from four to five feet, and it is some feet below the level of high-water mark, covered by brick-earth, of the same character as that still deposited by the Severn, to the depth of ten or twelve feet, indicating that it must have been submerged to a sufficient depth, for this accumulation to have been formed upon it, and subsequently uplifted to its present position. The same deposit is found on the opposite bank of the river, in the parish of Awre, and, as we are informed, on Walmer Common, in the parish of Westbury-on-Severn, at Whitminster, and in other places near Gloucester, from which its extent may be inferred. We are not aware that these facts have been previously noticed by other writers.

The trees, when fairly uncovered in excavation, occur in great numbers, and very large "Stag Horns" were found amongst them, some of which are said to have been taken to Berkeley Castle.

An entire skull of the *Bos primigenius* was found in the Severn, not very far from Sharpness Point, nor the spot where the fresh water of the Royal Drough, on the bank-cuttings of which these trees are now best seen, and which runs in places through the peat bed, still keeps open a channel through the sands.

The transition from old geology to new is easy enough in theory, but it would be difficult to find another locality, where recent changes have been effected to the same extent as in this.

Many of the older inhabitants of Purton have assisted in the discharge of cargoes of stone and coals upon the canal banks, from vessels which could not now approach them from the Severn within the distance of nearly a mile, the operation of the breakwaters erected by the late Earl Fitzhardinge, having converted, within their recollection, a large tract, once washed by the tidal waters, into fertile soil. The quantity of stone applied to the construction of the breakwaters, to which we have frequently referred, has been enormous, and each has been the work of many years; but though the cost of them may not be commensurate with the value of the land reclaimed, it must be remembered that the work, when first

commenced, was defensive—not aggressive—and therefore has not rendered merely passive results.

Some idea of the alternately destructive and recompensating action of the river at this point, may be formed from the following information which has been communicated by W. B. CLEGRAM, Esq., the resident engineer of the Gloucester and Berkeley Canal Company:—"The sub-contractor of the Canal between the Cambridge Arm, and Purton, tells me that he retains a distinct recollection of the excavation for the foundation of the bridge walls and platform at the Shepherd's Patch, which is now a mile and a quarter distant from the Severn, and that at a depth of from 15 to 16 feet below the present surface of the meadows, which are called the New Grounds, they came to the old river mud, upon which were the footmarks of sheep and cattle, as distinct, and sharply defined as though they had been made the day before, extending over a considerable area. These marks were filled up with pure clean sand and mud; sometimes in separate deposits, sometimes mingled together. The mud excavated and exposed to the action of the air, dried and divided into laminæ about the eighth of an inch in thickness, showing the quiet tidal deposits. I think you may rely on these facts, as my informant is an observant and intelligent man. The work referred to was executed thirty-nine years ago."

Similar facts were observed also at the Cambridge Arm, at a distance of about a mile from the last-named locality.

This is interesting, as teaching us that the Severn silt probably extends inland between the points indicated, to a very considerable distance, and that the deposit has been swept away and replaced numberless times; and showing how simply, naturally, and perfectly, traces of life so readily effaceable as footprints, may be preserved.

Should further conservative measures now in contemplation, and of which the preliminaries have been executed, be carried out, another very extensive tract of fertile land will in the course of a few years be reclaimed from the river here.

If it be interesting to observe the gradual change of vegetable and animal life, which takes place upon draining a small marsh or pond, and submitting its soil to ordinary culture, how much more so must it be to watch the sea shore, or that of an estuary gradually accommodating itself to the conditions of inland existence; and this we may do here. It is just at this spot where the struggle for preponderance, between the estuarine and marine conditions and forms of life is going on. Congers of considerable size prowl over the sands before us, and are sometimes left stranded upon them. Porpoises, and even whales, have been taken far above us; indeed, it is upon trustworthy record that a man was killed, while bathing at Worcester,

by a sword-fish.* *Lophius Europæus* was caught at Newnham, but a few years since, and exhibited to the Club. The Anchovies, *Engraulis encrasicolus*, *Flem*, (which is not considered a common British fish,) must be here in considerable abundance, for they are sometimes caught to the number of a dozen in a tide, in the wicker baskets called *puts*, which are set for salmon, and it attains here the full size ascribed to it by Yarrell—that is to say, to 6 or 7 inches in length, which is greater than its usual size in the warmer seas, where it occurs in greater abundance. Shrimps may be had for the taking; and upon one occasion (about 1845,) the river here was so full of sprats, that it was only necessary to lower a basket into the water to obtain a supply. It may, probably, be remembered that an extraordinary flight of the Arctic tern passed inland as far as Worcester, about the same time, in such numbers as to be readily knocked down by stones thrown amongst them. If we turn over a stone or piece of drift-wood just within high-water mark, we disturb swarms of Sandhoppers, *Talitra locusta*, or its more sedate companion, *Ligia oceanica*, which the unscientific, would probably mistake for a gigantic woodlouse. If still incredulous as to our vicinity to the sea, or to marine conditions of life, we have only to feel our way carefully at low water, along the edges of the Silurian rocks which stretch out into the river, where the *Dictyophyton feniculatum* grows upon them, to find a few periwinkles (*Littorina littorea*), *tellina crassa*, or *Syndosmya alba*. Amongst the Fuci, (*Fucus vesiculatus*) *Littorina tenebrosa* is not uncommon. The empty shells of these species are found occasionally sparingly scattered over the sands as far as Fretherne, but we have seldom met with living specimens beyond this point. The current which brings them hither carries them, no doubt, much further, but as there are no rocks to afford them shelter beyond this place, except those of which the breakwaters are formed, they probably become embedded at such depths, in the ever-shifting sands, as to deprive them of life.

Amongst the captures of rare fish made in the Severn, which have come under our notice, may be mentioned the *Morris*, *Leptocephalus Morrisii*, (Yarrell, vol. 2, p. 311,) of which, a specimen was taken at Framilode, in May, 1845, and is now in the possession of T. B. LI. BAKER, Esq., of Hardwicke Court.

Since the above was written, (in the month of August, 1863,) several grampuses (*Phocæna orca* of CUVIER) have been captured in the Severn, near this place, and one within three miles and a half of Gloucester. They are supposed to have been in pursuit of a large shoal of salmon, as the unusual number of forty-five was taken on the same day, at Minsterworth, near the place where the last named was captured. The largest of these was twenty-two feet and the smallest nine feet in length. Porpoises (*Phocæna communis*) are seen here in small numbers much more frequently, and the common species of seal (*Phoca vitulina*) has been seen repeatedly upon the English stones near Beachley within the last few years.

Drawing nearer the shore, upon some of the most recently deposited layers of mud, we find patches of *Salicornia*, the Saltwort, one of the first pioneers of land vegetation, for the places where we remember to have first seen it are either covered with *Scirpus maritimus*, *Glaux maritima*, or the short grasses and carices which succeed these, of which cattle appear to be extremely fond. A large mass of lias which has fallen from the cliff into such a position as to be washed only by the highest tides, is covered entirely by *Plantago maritima*. The Saltwort, under the name of Samphire, is gathered and eaten either as a pickle or as a substitute for asparagus, and is said to be very wholesome.

From out of the mud-cracks formed by the sun, and shaken by our footsteps, rush numberless *Bembidiidæ* and other small beetles, the pedigrees of which would once have excited our highest curiosity, but whose acquaintance upon the present occasion, we decline to make upon any terms.

Further from the river, we find other ponds, smaller and shallower than any we have yet examined, too shallow indeed for sticklebacks, though not void of inhabitants, for, as we intercept the sunshine from one of them, the bottom is seen to be covered by a shoal of small crustaceans, resembling Gammarus, which immediately move away rapidly towards the opposite side. Two or three strange-looking, whitish objects, about an inch in length, and a line in breadth, are now crawling leisurely over the mud, now swimming rapidly, anon rising to the surface, and apparently dividing their bodies from one extremity to beyond the middle, groping along the surface with the points of the divided portion. Capturing some of these, we find that the division is caused by the expansion of a pair of claws, longer than the entire body, and that the creature is an amphipodous crustacean, probably the *Corophion* of CUVIER. *Spherosoma dentata*, and *Næsa bidentata*, are also present in considerable numbers, and with *Ligia oceanica* and *Talitria locusta*, both of which may be found amongst the Driftwood, or under stones above the tide-reach, and species yet to be mentioned, form an array of its order, with which we are surprised to meet. We are forcibly reminded by the first-named of these, of the outlines of the *Bumastis Barriensis* of the Woolhope beds of the Silurian formation, which may have resembled them in its habitudes, crawling with its slender feet, or swimming slowly by their aid, and possibly, that of similar caudal appendages, over the unctuous mud of its haunts.

Returning to deeper fishing, we discover in a muddy pool which has evidently received an accession to its waters from the tide, a few fronds of *Fucus vesiculosus*, which we carelessly lift out with the net, and to our great surprise, find that we have at the same time bagged half a dozen of

the prawns which are common in marine vivaria, (*Palemon squilla*), all laden with ova; as many sticklebacks of the common species, so far surpassing in brilliancy of colour any we remember to have seen, that we formed a resolution upon the spot to endeavour to transfer their tints to paper; and, lastly, what appears to be a full grown loach! the last a take which puzzles us amazingly, as the water is brackish.

One of the sticklebacks, a male, in full nuptial costume, has eyes much larger, and more projecting than any specimen ever previously captured by us; so large and projecting indeed, that seen from above, they looked like two globes, inserted to the extent of about a fourth of their diameter only, in the orbital cavity; the pupil of a deep, lustrous, velvety black, the iris on its inner margin of a bright ultramarine, and upon the outer circumference of a deep crimson lake colour: its back of a lovely dark velvet green, becoming brighter along the sides, and shading off around the the under portion of the fish, into what in various lights appeared at times to be dull gold, or bright silver. The lower part of the head, and fore part of the body was of vivid scarlet, partially paling, and partially deepening upon the gill plates into shades of purple. The females were all of a delicate warm brown above, and of a most charming tint below, which we know not how better to describe than by calling it a combination of pearly nacre and burnished silver. These were, of course, reserved for the vivarium, and we may here relate all that we might have to say of them in the sequel.

To try the hardihood of these little fish, we placed them in a large fresh-water vivarium, in which were others of the same species from fresh-water ditches, when they immediately made themselves at home, and appeared to suffer no inconvenience from the change of water. In the course of little more than twenty-four hours, they had so completely assimilated themselves in colour to the old settlers, that they could no longer be distinguished from them. The male, probably from irritation, in the same period parted with much of his gay colouring, but his troubles were not destined to last long. Like the young Tobias, "heated with" (what you please) "a vehement dispute" with a detested rival shook the vase. We did not see him pen a challenge, nor did we see him send it, but certain it is that he fought and fell, and that after death all his brilliancy was restored for some hours, and we duly immortalised him.

Upon examining the supposed loach, which we retained in the water in which it was captured, we were surprised to find that the prawns themselves were not more diaphanous and colourless than itself. As it lay amongst them, the small dark mass of intestine, conformed in appearance so exactly to that of the dark mass of their eggs, that it was difficult for a

few moments, to recognize it. The next day, a few dusky, green and grey markings like those of the loach, were distinctly seen extending from the base of the caudal fin to the vent, the tail and other fins also becoming suffused with a faint olive yellow. In the course of two or three days, it had apparently become reconciled to its position, and resembled very much a loach in all its markings and colours, except that whilst the fins became sprinkled with dusky spots, arranging themselves in faint, ill-defined transverse bars upon them, the rays assumed a brownish yellow tint, and it stood revealed as an unmistakeable Goby. We have kept chameleons for many months together, we know therefore what we are about when we state that we have never witnessed greater changes of colour in the chameleon, than in this little fish, not referring, of course, to the difference of time in which each creature effected its changes. Under these circumstances, after having carefully compared the descriptions of COUCH and YARRELL, of all the Gobies known to them, we feel inclined to suggest that the *Gobius minutus* of Yarrell, and the *Gobius pellucidus* of COUCH may be merely the same fish seen under different conditions.

At intervals, still further from the river, we meet with other shallow excavations in the soil, (made apparently for the purpose of retaining water for the use of cattle,) totally unconnected with any water-course, and entirely dependent for their supply of moisture, upon rainfalls, or the overflow of the Severn. They can be replenished from the latter source, but seldom, so far as our experience extends.

The water which they contain is slightly brackish, but so is invariably that which rises from the liassic strata in the neighbourhood, when newly-pierced, and it so continues until by long-continued percolation of fresh water, the saline elements from the contiguous soil have been dissolved and exhausted. Presuming these small ponds to be chiefly dependent for their water-supply upon rainfalls, we may readily conceive that their brackishness is derived from the salt of tidal origin, inherent in the silt of which the grounds are formed, dissolved by similar processes.

None of these ponds afford traces of native vegetation, with the exception of a few fronds of the Bladder ulva, *Enteromorpha intestinalis*, which subsequent examination shows us to be covered with rare diatomaceæ, particularly *Navicula hippocampus* of large size and rich colour, in full activity; no *Hydrobiæ*, *Gyrini*, or other insect, and with the exception of a small annelid or larva, whose presence was evident from the small spots, in pairs, upon the surface of the mud, but which we otherwise failed to detect, no other life than that which we have already described, could be traced in their waters.

Here then, again, we find ourselves in a transitionary state of things

and the idea suggests itself that the inhabitants of these ponds may be as peculiarly adapted to the circumstances under which they exist, as the vegetation which we have already passed under review.

Drawing near to the edge of one of these, we discover a densely packed shoal of minute fish hastening from the shallows in which we have surprised them, to the deeps, which are, nevertheless, not sufficiently profound to conceal from us the footprints of the heron, which has lately been wading amongst them upon a tour of inspection: not that we may suppose that one of the little creatures we have seen could be worthy of his lordly notice, as not one of them exceeds an inch in length, and their lateral and ventral developments are absolutely insignificant. They have very much the appearance of sticklebacks, but the unanimous manner in which they move in shoals, upon the mere falling of a shadow over them, shows that they must be habitually subject to a degree of surveillance very different to that of their ordinary congeners, whose perfect composure or easy impudence in the wayside ditch, or in the vivarium, must have frequently attracted the attention of the observer.

We determine to satisfy ourselves of their specific identity, and contrive to cut off the escape of a portion of the shoal in a part of the excavation so shallow, that they cannot escape examination.

Sticklebacks, sure enough, are there, of the species commonest in the district, *Gasterosteus aculeatus*, with two spines, and *G. pungitius*, with nine, but we find that their companions in flight are the fry of fish, which are unknown to us in any of the neighbouring fresh waters, and which we are unable to identify. The old river bed, traceable from near the last-named breakwater for a distance of some three miles towards Frampton, still retains a considerable expanse of shallow water, although not in any way admitting it from the tidal portion, but affords as yet, few attractions; and, as compared with the smallest pond upon the older reclaimed land, shows itself to be as yet uncolonized. The only water-plant in view, from the spot where we stand, with the exception of one small patch of the bulrush, which has taken possession of an "ait" is the sombre *Chara nidifica*, the proliferous Stonewort or Water Horsetail, from amidst which, repeated sweeps of the dredge produce only a few specimens of a dirty, yellow-looking variety, of the common three-spined stickleback—*G. Aculeatus*, small examples of the common pond snail, *Limnæus peregrinus*, but no other mollusc or insect, even here indicating, that although cut off from the influx of the tidal current, its waters yet hold in solution from the soil, too many of the marine salts, and other elements with which it is impregnated, to fit them for the abode of the ordinary inhabitants of fresh water.

The calcareous incrustations of this *Chara* here, are also worthy of examination for the number of microscopic creatures attached to them, particularly of *Carchesium*, *Zoothamnium*, and the *Vorticellate Animalculæ* in general.

Upon leaving this spot, we ascend the sea-wall for the better enjoyment of the glorious prospect around us, but are immediately brought back to the subject of which we have been treating. The sight of wattle-stakes still thrusting their heads through the soil of what would at a short distance appear to be rich pasture land, reminds us that the vale of Gloucester for many miles further inland, even at so recent a period as the Roman occupation of Britain, must have presented conditions very similar to those around us, and that the valuable meadows which generally bear, in the counties of Worcester and Gloucester, the name of "Hams," have been reclaimed by operations, and industry, similar to those of which we are considering the traces.

A glance at the geological chart will show us in the Island of Alney, at Gloucester, and at Arlingham, for example, how great has been the deposit made by the river: and the knowledge of the fact, that water-worn stepping stones, Roman coins and fibulæ, have been found in river mud, from 12 to 14 feet below the surface level of Gloucester Quay, at a considerable distance inland from it, must convince us, that not later than the Roman occupation, at least, lakes or morasses must have existed where we now find fertile meadows. The discovery of rows of wattles, (precisely like those before us,) at a still greater depth below the surface, in the excavation known as "Tabby Pitt's Pool," must satisfy us that all the tracts of this district coloured in the maps as alluvial, have been recovered from the river in a similar manner, by intercepting its deposits. Whether these restrictions upon the encroachments of the Severn, were commenced by the Romans or by the Saxons, we know not, although from the statements just made, we may with greater probability ascribe them to the last-named people, and form a tolerably correct idea of the state of the country at the period we have more particularly referred to. Few amongst us would attempt to refute, after a careful consideration of the data upon which they are based, the conclusions at which MURCHISON and BUCKMAN have arrived, as set forth in the treatise upon the "Straits of Malvern," published by the Professor a few years since; but it may be new to many, in connection with the alleged antiquity of a race of men which once inhabited this country, to learn that a tradition of the existence of such a "strait" has come down to us from early times, in the pages of Nennius. We may reasonably infer that the recession of the sea, which has left strewn amongst the gravel beds of Upton-on-Severn,

Bridgnorth, and other far inland localities, remains of marine mollusca, of species still existing upon our coasts, was indeed gradual; that it was followed by the formation of a series of brackish and fresh-water lakes;— and finally by the obliteration of these, by the permanent sea-way, worn through them by the regular water-shed of the lands now forming the banks of the Severn and their relative districts. We have seen that the oolitic drift of the vale, containing elephant and hippopotamus remains, as deposited upon Purton Cliff, near Sharpness, has been abruptly cut through by the Severn, special facilities for such a proceeding being rendered at that point by the resting of the soft mud, and easily-disintegrated limestone of the lias upon the more resisting masses of Old Red and Silurian. We have seen the so-called Northern drift covering the superficial soil at the same locality, we know, therefore, that it has formed its present course *since* the last of the great geological changes to which the district in question has been subjected; and probably so readily traceable, in early times, as regards our human predecessors here, was the ancient strait, from the absence of the plough, or any considerable disturbance of the soil, that Nennius tells us upon the faith of tradition, "*Brittones olim eam (i.e. Britanniam) implentes, a mari usque ad mare judicaverunt.*"

It is true that he is speaking of two rivers here, of which the Severn is one, and the Thames the other, but the application of the sentence to the Severn in connection with the modern theory, is not the less curious or remarkable.

Up amongst the bushes which partially cover the lias cliff, as we are occupied chipping the upper band of stone, a sound of wings beating the air comes upon us, and, turning quickly round, we descry a barrow duck, or shieldrake, *Tadorna vulpanser*, in beautiful plumage, close upon us, steering directly for what we imagine to be a rabbit's hole, partly concealed by the disengaged roots of a hawthorn tree. Subsequent enquiries obtain for us the information that a pair or two of these birds have bred here from time immemorial, and that the young are frequently taken by the men who fish for salmon with hand-nets, and that they show an aptitude for domestication, which we think ought to be, but is not, duly encouraged. After remaining for a few days with the ducks of the establishment to whom they may be introduced, they are allowed to escape and rejoin their kindred. From the fact of the bird to which we more specially allude, continuing to wheel uneasily about the cliff without alighting we have no doubt that the supposed rabbit-hole was simply its proper abode, and the centre of all its hopes and fears.

From an isolated patch of *Scirpus maritimus*, upon the approach of a

fisherman, who, in his peculiarly light and airy, or rather amphibious costume, proceeding with his hand-net to capture any stray salmon, who, smitten by the beauty of the scenery, has chosen to disport himself in one of the pools, instead of proceeding upon his proper business up the river, rise a pair of the common sandpiper, *Tringa communis*, showing that they may be induced, by favourable circumstances, to remain here for the purpose of nidification and its concomitants; and, from the number of these birds with which we meet in the course of our ramble, we are satisfied that many other such patches are similarly tenanted.

The old Severn channel, before alluded to has still its special denizens. Wending our way for a short space along its banks, we startle more than one flock of wild ducks, still gregarious, although the breeding season can scarcely have terminated, whilst widgeon and teal, both of which evidently breed here, are to be seen only in pairs.

Peewits also are here in great numbers, upon the New Grounds, the males apparently frequenting the sands of the Estuary, while the females attend to domestic duties on the dry land, though at such distance as to enable them to keep up a constant interchange of vocal intercourse between the flocks, the cries of any individual of the one being immediately responded to from the other. We cannot positively affirm that any of our acquaintance tumbled along the ground before us to draw us from their nests, (or rather eggs,) according to the popular account of their habits, though they certainly exhibit considerable boldness in flying immediately over us with the same apparent intent, quitting us when we have proceeded to what they consider a safe distance, when another generally takes up the vacated post, and plays the same rôle.

The New Grounds are traversed by several artificial watercourses for the purpose of freeing the lands from flood and ordinary drainage-waters, which are called *reens*, from an Anglo-Saxon word cognate with the German word *reinen*, to purify or clean, signifying a running stream or gutter, and in these, water-hens and herons are particularly abundant, and from the freedom from personal annoyance which they here enjoy, afford the traveller every facility for studying their manners and customs. Armed with one of Burrows's best Malvern landscape glasses we enjoy special advantages in this respect, and watch them preening themselves, or diving for the creatures upon which they feed, as though no such creature as man had ever disturbed them.

Upon one occasion we counted nearly thirty herons standing upon the breakwater, and many others were upon the sands around it. Having inadvertently disturbed them, we walked out upon it, to see whether any traces of their food might remain, or whether the small

shallow pools of water around it, might be sufficiently clear to enable us to discover what made this point so attractive to them. In the latter not a trace of life was discernible, and of the former we found only a pellet of fur, from the centre of which peeped, what proved to be the tail, and a few of the larger bones of the water vole. About half-way along the wall, were also the well-picked limbs of a rabbit, the state of which we also should have ascribed to the omnivorous propensities of the bird, but were informed that they were indubitably the remnants of the meal of a fox, which had been observed to frequent the spot for some time past. Upon expressing some surprise at this animal selecting such an exposed position for a resting or feeding place, we were informed that the breakwater, near the Berkeley Arms, composed of rough uncemented stones, loosely thrown together, is a not uncommon place of refuge for this animal when hard pressed, in the cavities of which it is perfectly safe from any danger but that of a high tide. It is said to prey to a considerable extent upon the wild geese which frequent "the grounds," and which are their principal tenants from the time of their arrival about Michaelmas day, and that of their departure, which takes place with equal regularity about the twenty-fifth of March.

From the sounds arising from time to time from Lord Fitzhardinge's decoy ponds, one of which is also on the New Grounds, they appear to be as well tenanted by ducks.

Upon the sands are three kinds of gull in considerable numbers, which, as well as the heron, from the great distance at which they are found from the nearest breeding places of their tribe, are probably young of the year. The sea mew, *Larus minutus*, the black-backed gull, *Larus marinus*, and the common gull, *Larus canus*, may be clearly distinguished, as they are far less timid than the lapwings, amongst which they are scattered.

Whilst speaking of the birds of the district, we may mention that at the inn we saw a stuffed specimen of the curlew, *Numenius torquatus*, which was one of many found dead upon the sands during a long-continued frost of the last hard winter. Whether the frost acted so rapidly upon the sands, at low water, as to prevent their perforation by the bird's slender bill, or whether the intense cold drove the creatures upon which it fed too far from the surface to be reached by it, we were not informed, but we were assured that it was literally starved to death. These birds do not appear to frequent this district by day, but their cry is frequently heard in the night time.

The interest manifested by ourselves in similar anecdotes of birds, led to the discovery, that our host had been a close, though unconscious, observer

of many of their habits, and he told a story of a young cuckoo which may be worth repeating, the truth of which, he avers, can be established by several members of his own family. Having enquired what we thought of the alleged migration of the cuckoo, and received the natural reply, he startled us by stating that we were quite wrong, and that they had frequently been found in hollow trees, in a torpid state, throughout the winter. He did not profess to have seen any of these birds himself, but said that he had heard of them "from old men who had found them," several times in his life, but to the following statement he insisted upon full credit being given. Some years ago, a young cuckoo having been found in the nest of a hedge sparrow, near the house of his brother, (a respectable farmer, still resident in the neighbourhood,) the attempt to keep it through the winter was determined upon by some of the family. The bird appeared to thrive satisfactorily for some time, but, in the month of November, the cage was one day found open, the bird gone, and no more was thought of the circumstance. Upon the shelves of the dresser of the kitchen in which the bird had been kept, were ranged pewter platters, which, but a few years since, were common in the farm houses of the district, although never used. These were invariably scoured and brightened for Christmas, and, being taken down a day or two prior to Christmas day for the purpose, behind one of them, in the words of my informant, sitting with his feathers all around him, "there was the cuckoo as naked as a worm," but it did not live long afterwards, in consequence of some negligence on the part of those who had the care of it.

But many hours have been spent here, and we must leave the New Grounds, and all that further pertains to their history, satisfied if we have succeeded in directing them to the attention of any one who has leisure to fully work out the subject. The silt of which they are composed, has itself a story to relate.

By the kindness of W. B. CLEGRAM, Esq., who has paid much attention to the Diatomaceæ, we are enabled to present the following list of species, made out by him, as occurring in great numbers in the Severn mud, for the use of those who may feel inclined to pursue the subject further, as a great many of those comprised in it may be met with here.

**Pleurasigma double-angulatum* (very large and beautiful)

* Mr. Clegam remarks that "the large *P. angulatum* is a very distinct and beautiful variety, and I have never seen it from any other locality. The mud from which they were taken was obtained on the shore of Kingroad. All were taken from within the reach of salt water, besides a *host* of others, which I cannot class from any drawings which I have seen. I doubt whether many of the book varieties are varieties at all, or merely different stages of growth, or under other conditions."

<i>Pleurasigma angulatum</i>	<i>Nitzschia spectabilis</i>
——— <i>elongatum</i>	——— <i>bilobata</i>
——— <i>littorale</i>	<i>Raphoneis gemnifora</i>
——— <i>strigilis</i>	——— <i>fasciolata</i>
——— <i>Balticum</i>	——— <i>pretiosa</i>
——— <i>hippocampus</i>	——— <i>rhombus</i>
——— <i>fasciola</i>	<i>Pinnularia nobilis</i>
——— <i>quadratum</i>	——— <i>viridis</i>
——— <i>transversale</i>	——— <i>alpina</i>
<i>Navicula liber</i>	<i>Triceratium favius</i>
——— <i>elliptica</i>	<i>Amphleura sigmoidea</i>
——— <i>Jennerii</i>	<i>Amphora incurva</i>
——— <i>convexa</i>	<i>Gomphonema cristatum</i>
<i>Nitzschia sigmoidea</i>	<i>Doryphora amphicerus</i>
——— <i>sigma</i>	<i>Suritella striatula</i>

Upon this list a gentleman who has made the tribe a special study, JOHN ABERCROMBIE, Esq., M.D., of Cheltenham, has favoured us with the following highly interesting remarks :—" This list is most extremely interesting as presenting four species of the genus *Raphoneis*, which is not mentioned at all in SMITH as a British genus, with the exception of *Amphora* as a synonym for *Doryphora*. Of the four named, three are American and one Antarctic, according to Ehrenberg—of the three American two are fossil,—so that if these are all now living in the estuary of the Severn, it is a most interesting circumstance, and one quite worthy to be made more generally known. The specimens of *Dictyophyton faniculatum* mentioned as growing upon the Silurian rocks proved to be completely covered with the frustules of *Cocconeis scutatum*.

Pondering upon the incidents of the day, not, we feel, ill-spent, we make our way to the canal bank at Frampton, passing the brick-pits, which afford, amongst the bulrushes and other water plants which fringe their sides, a secure asylum to many coots and water hens, and, passing through the churchyard and pretty village, with its spacious green, and memories of Fair Rosamond, of which foremost comes to mind a scrap of her epitaph—

Non redolet sed olet quid prius redolere solet,

we take brief rest, and light refreshment, with mine host of the Bell, as we have still a walk of nine miles before us. Thence to Whitminster, again through a churchyard, glancing rapidly over gravestones inscribed with many familiar names. One of these, over all that was mortal of a philanthropist, well known in his day, and still remembered by all who knew him with respect and honour, revives those feelings in us

with redoubled force, as it shows what the man was, not only in his relations to the world, but more particularly to his domestic circle. Around the plain iron railings which enclose his grave, sleep many of his servants, garnered, like himself, after years of good service, the desire of each apparently having been to lie as nearly as possible by "the master," even in death. But the shadows are gathering round us, increasing rapidly in length and massiveness, and we once more cast lingering glances on the more distant outlines of the well-known landscape fading under the subdued light of the setting sun. It is fancy, but his rays *seem* to linger also, like ourselves, upon spots visited in years long gone by, when, in the freshness of our ardour in the pursuit to science, "were all emotions beautiful and new." As the pall of night settles over them, we musingly continue our journey homewards, shaping, as far as possible, into the record here given, the thoughts and events of an August day.

Report on Miss Holland's Collection of Lias Fossils.

By THOMAS WRIGHT, M.D., F.R.S.E., F.G.S.

HAVING been requested by our president, Captain GUISE, to make an examination of, and report upon the collection of Fossils obtained by Miss HOLLAND from the Lias of Dumbleton and its vicinity ; on the kind invitation of EDWARD HOLLAND, Esq., I visited Dumbleton Hall on the 25th September last for that purpose. I take this opportunity of returning Miss HOLLAND my very best thanks for the very efficient assistance she afforded in carefully examining every specimen with me ; all the localities of the different species had been carefully noted at the time they were found, this accuracy on the part of the collectors, rendered our task comparatively easy, and enabled me to make this report with much confidence in the general correctness of the statements it embodies.

The Lias beds in the neighbourhood of Dumbleton belong to the Lower, Middle, and Upper Lias.

THE LOWER LIAS.

The Lower Lias is exposed in a cutting near Toddington, on the Stow road, on the west bank of the river Isborne, from this locality several fossils belonging to the Zone of *Ammonites obtusus* were found. These were :—

Ammonites obtusus, Sow. Two very good specimens.

" *stellaris*, Sow.

Nautilus striatus, Sow.

Gryphæa incurva, Sow.

Ostrea, (nov. sp.)

The Zone of Ammonites raricostatus.

This Zone is represented chiefly by the Hippopodium bed. I found, however, *Ammonites densinodus*, Quenst., *A. Carusenses*, d'Orb. *Gryphæa obliqua*, Sow., and *Hippopodium ponderosum*, Sow.

THE MIDDLE LIAS.

The Zone of Ammonites Capricornus.

This Zone is well exposed near Dumbleton Hall, in the brick-yard I found many fragments of its characteristic shell ; the clay is of a good quality, and is dug extensively for the manufacture of different kinds of pottery. I found the following species in Miss HOLLAND's collection, all of which were collected from this pit.

CEPHALOPODA.

Ammonites Henleyi, <i>Sow.</i>	Nautilus truncatus, <i>Sow.</i>
" capricornus, <i>Schloth.</i>	Belemnites paxilolus, <i>Schloth.</i>
" Loscombi, <i>Sow.</i>	Belemnosepia (nov. sp.)
" fimbriatus, <i>Sow.</i>	

GASTEROPODA.

Trochus imbricatus, *Sow.*

CONCHIFERA.

Gryphæa cymbium, <i>Lamck.</i>	Lima Hermanni, <i>Voltz.</i>
Inoceramus ventricosus, <i>Sow.</i>	Unicardium cardioides, <i>Phil.</i>
Cardinia attenuata, <i>Stutch.</i>	Mytilus hippocampus, <i>Y. & B.</i>
Leda rostralis, <i>Lamck.</i>	Cucullæa Münsteri, <i>Ziet.</i>
Pinna folium, <i>Phil.</i>	Modiola scalprum, <i>Sow.</i>
Pholodomya ambigua, <i>Sow.</i>	Arca elongata, <i>Quenst.</i>
" decorata, <i>Goldf.</i>	Astarte, (nov. sp.)
Limea acuticosta, <i>Goldf.</i>	Pecten equivalvis, <i>Sow.</i>
Gervillia lævis, <i>Buck.</i>	Pleuromya unioides, <i>Roem.</i>

BRACHIOPODA.

Rhynchonella rimosa, *v. Buck.* Rhynchonella tetrahedra, *Sow.*

ECHINODERMATA.

Pentacrinus robustus, *Wright.*

Zone of Ammonites margaritatus.

CEPHALOPODA.

Ammonites fimbriatus, <i>Sow.</i>	Ammonites heterophyllus amalthei
" margaritatus, <i>Mont.</i>	<i>Quenst.</i>
several varieties of	Nautilus intermedius, <i>Sow.</i>
this species	" striatus, <i>Sow.</i>
" Engelhardtii, <i>d'Orb.</i>	Belemnites paxillosus, <i>Schloth.</i>
" Normanianus, <i>d'Orb.</i>	" compressus, <i>Stahl.</i>

GASTEROPODA.

Pleurotomaria Anglica, <i>Sow.</i>	Chernnitzia, undulata, <i>Ziet.</i> , two
" expansa, <i>Sow.</i>	species
" undosus, <i>Schübl.</i>	Turbo, two or three species
Trochus imbricatus, <i>Sow.</i>	Actæonina, two species

CONCHIFERA.

Ostrea pycniformis (nov. sp.)	Plicatula spinosa, <i>Sow.</i>
Gryphæa gigantea, <i>Sow.</i>	Monotis equivalvis, <i>Sow.</i>
Pecten equivalvis, <i>Sow.</i>	Lima duplicata, <i>Sow.</i>
" cinctus, <i>Sow.</i>	" gigantea, <i>Sow.</i>
" diversus, <i>Buck.</i>	" Hermanni, <i>Voltz.</i>

<i>Lima pectenoides</i> , Sow.	<i>Unicardium cardioides</i> , Phil.
<i>Limea acuticosta</i> , Goldf.	<i>Cardium truncatum</i> , Phil.
<i>Pinna folium</i> , Phil.	<i>Cypriocardia cucullata</i> , Goldf.
<i>Pholadomya ambigua</i> , Sow.	<i>Modiola scalprum</i> , Sow.
<i>Homomya</i> (?)	<i>Arcomya elongata</i> , Roem.
<i>Pleuromya unioidea</i> , Roem.	<i>Cardinia crassissima</i> , Sow.
" <i>rotundata</i> , Goldf.	<i>Goniomya capricorni</i> , Wright
" <i>donaciforme</i> , Goldf.	<i>Solen</i> (?)
<i>Ceromya lineata</i> , Williamson	

BRACHIOPODA.

<i>Terebratula punctata</i> , Sow.	<i>Rhynchonella acuta</i> , Sow.
" <i>resupinata</i> , Sow.	" <i>tetrahedra</i> , Sow.
" <i>cornuta</i> , Sow.	" <i>variabilis</i> , Schloth.

ECHINODERMATA.

<i>Hemipedinia Jardinii</i> , Wright	<i>Pentacrinus subangularis</i> , Mill.
" <i>quadrifida</i> , Lamck.	<i>Spirifera rostralis</i> , Schloth.

In the Sands above and below the Marlstone several thin seams of fossiliferous bands occur; some of those above the marlstone are highly ferruginous, and full of the casts of small shells, of the same species as many in our list. *Cardium truncatum* is found small, and in abundance, in blocks obtained from the highest point of the marlstone on Dumbleton Hill.

Zone of Ammonites spinatus.

The Zone of *Ammonites spinatus* is here so closely united with the marlstone, that it appears to form its upper portion, lithologically, it is a light coloured friable bed, containing many fossiliferous nodules. *Ammonites spinatus*, Brug.; *Belemnites brevisformis*, Ziet.; *Lima Hermannii*, Voltz.; *Terebratula punctata* and *Spirifer rostratus*, Schloth., are the prevailing forms.

THE UPPER LIAS.

The Upper Lias caps the summits of Alderton and Dumbleton hills, and attains a thickness in these localities of 150 feet; the lower part of this formation is exposed in the marlstone quarries, where it consists of beds of stiff clay, about 30 ft. in thickness, divided by a band of large light-coloured argillaceous nodules, containing many species of fishes and insects in fine preservation, and called the Fish-bed. The fossils of this formation are all specifically distinct from those of the marlstone on which it rests conformably. The Ammonites of the group CAPRICORNI are all absent from these beds; and in their stead have appeared great numbers of the groups FALCIFERI and PLANULATI; from the prevalence of one species of the latter I have named this division of the Upper Lias the Zone of

Ammonites communis. The best development of this zone is found near the Peak, and between Robin Hood's Bay and Whitby on the Yorkshire coast.

The light coloured limestone nodules forming the Fish-bed, have afforded specimens of the following genera of Fishes and Insects :—

FISHES.

Sauropsis, Pachycormus, Pholidophirus, Lepidotus, Leptolepis.

INSECTS.

Miss Holland informs me "that she has specimens which correspond with the following plates and figures in Brodie's Fossil Insects:—Plate vii., figs. 2 and 6; Plate viii., figs. 2, 9, 10, 11; Plate x., fig. 4; with unfigured specimens of two insect bodies without wings, one body with one wing attached, and several bodies with folded wings, two beetles, and six wings."

CEPHALOPODA.

<i>Ammonites cornucopia</i> , <i>Y. & B.</i>	<i>Ammonites fibulatus</i> , <i>Sow.</i>
" <i>Normanianus</i> , (?) <i>d'Orb.</i>	" <i>communis</i> , <i>Sow.</i>
" <i>serpentinus</i> , <i>Schloth.</i>	The Aptychi of several species
(with aptychus)	Loliginites, two or three species
" <i>radians</i> , <i>Rein.</i>	

GASTEROPODA.

Alaria, impressions of two or three specimens.

CONCHIFERA.

<i>Pecten cinctus</i> , <i>Sow.</i>	<i>Cucullæa Münsteri</i> , <i>Goldf.</i>
<i>Goniomya tetragona</i> , <i>Wr.</i>	<i>Lithodomus</i> in fossil wood
<i>Inoceramus dubius</i> , <i>Sow.</i>	

CRUSTACEA.

<i>Glyphea</i> , (nov. sp.)	<i>Eryon Barrovensis</i> , <i>McCoy</i>
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ECHINODERMATA.

Acrosalenia crinifera, *Quenst.*, on thin slabs with hair-like spines
Pentacrinus, (nov. sp.)

From these beds Miss HOLLAND has also obtained three teeth, a small bone supposed to belong to a Pterodactyle, some portions of the skin of an Ichthyosaurus, and a Fern belonging to a new species.

DECEMBER, 1862.

List of Reptiles found in Gloucestershire.

By JOHN JONES.

ALTHOUGH the following list will not be found to differ, as regards the number of species recorded, from that of many other British localities, I am induced to offer it to the Cotteswold Club, for the purpose of calling attention to habits of some of the animals named, which have not, I believe, been noticed by the authors of popular publications in which they have been mentioned.

Chelonia imbricata, the Hawk's Bill Turtle, is said by Dr. TURTON to have been taken in the Severn in the year 1774, and having since been taken in the river Parret, in Somersetshire, as recorded by Mr. W. BAKER, of Bridgewater, in the proceedings of the Archæological Society of that county, I presume to record it as an occasional visitant of ourselves.

Zootoca vivipara, the Viviparous Lizard, is not uncommon upon dry banks, particularly in the Forest district and about May Hill. It is probably equally common throughout the district; but from its timidity, combined with the correspondence of its colour with the ground upon which it basks, and the rapidity with which it retires upon being approached, it generally eludes observation.

Anguis fragilis, auct., the Blind or Slow-worm. Common.

Natrix torquata, the common Ringed Snake. One of these, which I kept for a few months, I have seen dart at flies upon a sunny garden wall. Is it in wait for this kind of prey that it basks in sunny places, and not merely for the enjoyment of warmth?

Vipera communis, the Adder or Viper. By no means uncommon, and in many places where its existence is not suspected. Particularly abundant in the Box wood at Boxwell, where it is said to attain to a larger size, and to assume brighter markings than usual.

Rana temporaria, the common Frog. Everywhere.

Bufo vulgaris, the common Toad. Common everywhere, but requiring further observation as to its breeding places to modify certain ideas respecting it, which appear to have been stereotyped for popular Natural

Histories. I have not unfrequently met with the young in great numbers together, smaller in size than the young of the frog when it leaves the water, and in places remote from watercourse or pond. From its known habit of entering holes and fissures which it can never again quit of its own will, could the fact be established that this reptile can propagate in moist places, or in a very small quantity of water, it would enable us to account for its appearance in numbers, in the anomalous situations in which it has been lately discovered, as set forth in *The Times*.

Triton cristatus, the Salamander or Warty-Newt, appears to replace the common species in certain portions of the district; for instance, in the neighbourhood of Tortworth, where, during one season at least, it appeared to abound, whilst the first named was comparatively rare.

The statement in the *English Cyclopædia*, "that this species habitually lives in the water, and is seldom to be found on land, unless the pond which has been its abode is dried up, and the animal is obliged to walk in search of another," does not accord with my own observations. At the end of the breeding season this species uses every endeavour, like *T. punctatus*, to leave the water; and I have found it under stones near ponds where no diminution of the water had taken place. In the course of the last year a very large specimen escaped from my vivarium, and was found early during the present spring in the cellar, in perfect health. Upon being handled it emitted a powerful odour insupportably disgusting. The largest specimen I ever saw of this species was found during a dry summer under a stone in a ditch at Corse, measuring fully nine inches in length.

Whilst searching for small mollusca amongst the roots of grass, I have found, not unfrequently at a considerable distance from water, a small newt, which agrees in general character with the description of the young of this species, but thinner and more delicate in all its proportions; and which can bear the privation of moist atmosphere for a very short time. Upon transferring one of these to a collecting-box, for two or three hours only, upon my arrival at home I found it dead, and so dry and rigid that no further process was necessary for its preservation. It may possibly be the young of the next species.

Lissotriton punctatus, auct., the Smooth Newt, is the commonest species in the Vale of Gloucester, and is much more active in its habits than the last named.

Lissotriton palmipes (?) is a species mentioned by Mr. BAKER, in the paper before referred to, as occurring in the neighbouring county of Somerset, but totally unknown to me. I name it here merely to call

attention to its existence so near to us, and to stimulate observation on the part of other members, in order to render our list as perfect as possible.

Lacerta viridis, the Green Lizard, was many years since introduced from Guernsey, and an attempt made to naturalize it at Leckhampton. I was informed that one or more specimens were seen in succeeding summers upon the side of the hill, but as I have not heard of them for a long time I presume that they have died out in that locality.

On the doubtful nativity of Daucus Carota and Pastinaca sativa.

By J. BUCKMAN, Professor of Geology and Botany.

It is now generally admitted that parsnips and carrots, in the state known to farmers and gardeners, are derived from wild plants: thus the edible parsnip is supposed to have been derived from the *Pastinaca sativa*, wild parsnip, now so common a denizen of our fields, and the *Daucus Carota*, wild carrot, equally common, is referred to as the original of the carrot. Now upon experiments in ennobling of our wild parsnip, I have already laid some evidence before the Cotteswold Club; it may, however, be well to remark that experiments in this matter, both as regards parsnips and carrots, have met with varied success.

Thus DE CANDOLLE is reported to have tried to improve the carrot, with success, whilst with the parsnip he utterly failed. Professor LINDLEY tells us that M. POUSARD has ascertained "that the wild parsnip becomes improved immediately when cultivated, and that experiments promise well,"—how well I have proved by developing a new and superior sort. Again with regard to the carrot, the Professor says—"that the hard-rooted wild carrot is really the parent of our cultivated varieties, remarkable as they are for the succulence and tenderness of their roots, has been experimentally proved by M. VILMORIN, who succeeded in obtaining, by cultivation, perfectly tender eatable roots, from seeds saved from plants only three or four generations off the wild species."

Still a modern French Naturalist, of great experience, M. DECAISNE, tells us that he has tried to ennoble the wild carrot and has not succeeded, and from this he draws the conclusion that our cultivated forms were especially created for the use of man. As we should suppose that very few botanists agree to this theory, we shall let the facts we have already brought forward stand in maintenance of its opposite, namely, that cultivated forms are derived from wild species, often apparently very different; at the same time, it may be well to state, that in all probability some of the discrepancies of experimenters may have arisen from some confusion in the species operated upon. In 1860 I gathered some seed of the *Daucus maritima*, (sea-side carrot) at Bognor, which, on being sown in a prepared plot the following spring, certainly resulted in fairly succulent roots, which, on being cooked, were pronounced by our party of four, to be excellent. While on this

subject it may be mentioned, as not a little remarkable, that so many of our garden esculents should be derived from sea-side plants, thus, probably carrots, but certainly celery, sea-kale, asparagus, and cabbage. This would seem to point to the fact that cultivation requires a complete change of the circumstances necessary to maintain a wild condition; and hence cultivated plants can only be kept up by the labours of a cultivator. Now whether the *D. maritima* is really a species is doubtful; I quite agree with BENTHAM in considering it as a variety of *D. Carota*; speaking of the former he says it is "a decidedly maritime variety, with leaves somewhat fleshy, with shorter segments, more or less thickened peduncles, more spreading umbels, more flattened prickles to the fruits, is often considered as a distinct species."

Quite as doubtful, too, do I consider it as to whether the Carrot or Parsnip are original wild natives of Great Britain. They are both amongst the earliest of our introduced plants, and they would appear to be both of southern and eastern origin; southern Europe and Asiatic Russia being the aboriginal localities for these plants.

They have both spread throughout the States in like manner as with ourselves, but they are not claimed as natives.

I have not had time to investigate the literature of these two plants, which I shall yet hope to do; in the mean time I leave the matter in the hands of our Club, feeling assured that it will elicit some interesting discussion.

On the Ammonites of the Lias Formation. By THOMAS WRIGHT, M.D.,
F.R.S.E., F.G.S.

BEFORE entering upon a description of the Ammonites of the Lias, I shall give a short account of the different zones of life into which this formation is now divided, with a view of defining more accurately the distribution of the different species of this group in time and space ; and likewise as an example of the value of Ammonites to the Palæontologist as indicators of time in the study of the secondary rocks.

English geologists divide this formation into Upper Lias, Marlstone, and Lower Lias, but these sub-divisions require additions and modifications in order to place the liassic beds of the British Isles in correct correlation with those of France, Switzerland, and Germany. For on the Upper Lias clays, in certain localities, are superimposed extensive arenaceous deposits, which, previous to the publication of my Memoir on the Upper Lias Sands,* were grouped with the Inferior Oolite, and in the Lower Lias are included several beds of clays and marls which, with the Marlstone of English authors, form the Middle Lias of continental geologists.

Taking the Lias beds so well exposed in their natural order of superposition in the North and South of England, in the magnificent sections on the Yorkshire and Dorsetshire coasts, and naming each group of beds by the most characteristic Ammonite contained therein, we find the following zones of life, taken in descending order :—

* Palæontographical and Stratigraphical Relations of the so-called Sands of the Inferior Oolite.—*Quarterly Journal Geological Society*, vol. xii., p. 292, 1856.

THE UPPER LIAS.—The sands of the Upper Lias forming the upper portion of this zone are characterized for the most part by Ammonites belonging to the group *Falciferi*, as *Ammonites opalinus*, Rein., and *A. radians*, Schloth.; *Ammonites Jurensis*, Ziet., and *A. insignis*, Schübl., both belonging to other groups, are likewise associated with them.

The clays of the Upper Lias, forming the lower part of the zone, are everywhere distinguished by other species of *Falciferi*, as *Ammonites bifrons*, Brug.; *A. serpentinus*, Schloth.; and numbers of the group *Planulati*, as *Ammonites communis*, Sow.; *A. anguinus*, Rein.; and *A. fibulatus*, Sow.

THE MIDDLE LIAS.—This is divisible into five zones, each characterized in descending order by :—1. *Ammonites spinatus*, Brug.; 2. *A. margaritatus*, Mont.; 3. *A. Capricornus*, Schloth.; 4. *A. Ibez*, Quenst.; 5. *A. Jamesoni*, Sow.

THE LOWER LIAS is divisible into seven zones. These are :—1. Zone of *A. varicostatus*, Ziet.; 2. *A. oxynotus*, Quenst.; 3. *A. obtusus*, Sow.; 4. *A. Turneri*, Sow.; 5. *A. Bucklandi*, Sow.; 6. *A. angulatus*, Schloth.; 7. *A. planorbis*, Sow.

Complicated as these sub-divisions may at first sight appear to those who have regarded the Lias merely as a great clay deposit, with a uniform fauna throughout, still their accuracy may be clearly demonstrated in the grand section on the Dorsetshire coast, extending from near Bridport Harbour on the east, to Pinhay Bay on the west.

Within these limits the entire series of beds rise beneath each other on the shore, and are exposed in the cliffs, so that this coast section may be said to be complete from the great arenaceous deposit of Upper Lias sand, containing *Ammonites opalinus*, with each succeeding zone of the Upper, Middle, and Lower Lias, down to *Ammonites planorbis*, and its *Ostrea* series resting on the *Avicula contorta* beds of the Trias formation.

In the table on the following page I have placed the different zones of the English Lias in correlation with those of Germany, so well described by Professors QUENSTEDT, OPPEL, FRAAS, and others; those of France, by the late M. A. d'ORBIGNY; those of England, by Sir RODERICK MURCHISON, Sir HENRY DE LA BECHE, and the Rev. W. D. CONYBEARE.

A tabular view of the correlation of the Lias Beds of France, Germany, and England.

SWABIA. <i>Quenstedt.</i>	WURTEMBERG. <i>Oppel.</i>	FRANCE. <i>d'Orbigny.</i>	SOUTH OF ENGLAND. <i>Wright.</i>	GLoucestershire. <i>Murchison.</i>	Dorsetshire. <i>De la Beche.</i>
Lias f. <i>Jurassienmergel.</i>	Jurassien-bett.	Tourcien	Zone of AMMONITES JURASSIENSIS	Inferior Oolite.	Lower Part of the Inferior Oolite.
Lias e. <i>Posidonien-schiefer.</i>	Posidonomyen-bett.	UPPER LIAS.	Zone of AMMONITES COMMUNIS	Upper Lias.	
Lias d. <i>Amaltheenhone.</i>	Spinatus-bett. Margaritatus-bett.	Liasien. MIDDLE LIAS.	Zone of AMM. SPINATUS. Zone of AMM. MARGARITATUS. Zone of AMM. CAPRICORNUS	Marlstone.	Micaeous Marl
Lias c. <i>Nummulitenmergel.</i>	Davisi-bett. Iber-bett. Jamesoni-bett.		Zone of AMM. IBER. Zone of AMM. JAMESONI	Ochraceous Lias.	Belemnite Bed.
Lias b. <i>Turnerithone.</i>	Raricostatus-bett. Oxynotus-bett. Obtusus-bett.		Zone of AMM. RARICOSTATUS. Zone of AMM. OXYNOTUS. Zone of AMM. OBTUSUS.	Hippopodium Cardinia beds	Ammonites in nodules.
Lias a. Sand u. Thonkalke.	Tuberculatus-bett. Bucklandi-bett. Angulatus-bett. Planorbis-bett.	<i>Stachurien.</i> LOWER LIAS	Zone of AMM. TURNERI. Zone of AMM. BUCKLANDI. Zone of AMM. ANGULATUS. Zone of AMM. PLANORBIS	Ammonite Bed. Plagiostoma Beds. Saurian and Insect Beds.	Lias Limestones.
Vorläufer des Lias.	Bone-Bed.		Zone of AVICULA CONTORTA.	Black Shales and Bone Bed Shales	White Lias upper part White Lias lower part Lower Marl Bone-Bed.

AMMONITES, *Bruguière*, 1792.

CORNU AMMONIS, *Lister*, *Lang*, and other old authors.

AMMONITES, PLANULITES, ORBULITES, *Lamarck*.

ORBULITES, AMMONITES, *de Blainville*.

PLANULITES, ELLIPSOLITES, AMALTHEUS, PELAGUSE, SYMPLEGADE, *Mont*.

AMMONITES, ELLIPSOLITES, *Sowerby*.

NAUTILUS, ARGONAUTA, *Reinecke*.

AMMONITES, PLANULITES, GLORITES, CERATITES, *De Haan*.

Animal unknown ; shell multilocular, spiral, discoidal, compressed, or ventricose ; whorls regularly convoluted on the same plane, always contiguous, and more or less involute ; chambers separated by transverse septa, flat or convex in the middle, and deeply sinuated at the outer border, forming on the mould, beneath the shell, a very complicated arrangement of branching sutural lines ; siphuncle external, dorsal as regards the shell ; dwelling chamber large, sometimes exceeding an entire whorl ; mouth variously formed, often contracted, and compressed, elliptical, oblong, rounded, quadrate, or ventricose, according to the shape of the shell ; aperture furnished with thickened bands, or lateral processes of various forms and dimensions in the different species.

The marginal foliation of the septa was supposed by VON BUCH, who first described them in detail, to afford a permanent character for the diagnosis of the species ; to facilitate their description he called the outlines of the septa *sutures* ; when they are folded the elevations are *saddles*, and the intervening depressions *lobes*, which form the more subdivided and branched portion of the edges of the septa, and extend backwards from the aperture ; the saddles are less subdivided, their folioles more rounded, and they project forward towards the mouth.

The lobes are divided into dorsal, superior and inferior lateral, auxiliary, and ventral.

The *dorsal lobe* is single, surrounds the siphuncle, and occupies the middle region of the back of the shell. The *superior lateral lobe* is in general large, and situated at the upper third of each side of the whorl.

The *inferior lateral lobe* is smaller than the superior lateral, and is seen on the lower third of the whorl ; the *auxiliary lobes*, two or three in number, are disposed obliquely near the inner margin, and the single *ventral lobe* is situated in the middle region of the whorl, opposite the dorsal lobe, and resting upon the previous turn of the shell.

The *saddles* are subdivided into the *dorsal saddle*, situated between the dorsal and the superior lateral lobes ; the *lateral saddle*, between the superior lateral and inferior lateral lobes ; and the *auxiliary saddles*, between the auxiliary lobes.

The lobes and saddles vary with age in different species ; not only do their ramifications increase in complexity during the whole life of the animal, but their number augments with growth. According to von BUCH, all Ammonites have only *six* lobes, the *dorsal*, *ventral*, and two *lateral*. In some species this number continues the same through life, whilst in others, one, two, or more auxiliary lobes are added to the laterals on each side ; and their number and development increase with the age of the individual. Notwithstanding this change in the form and number of the lobes of Ammonites with age, and which detracts much from their diagnostic value in the determination of the species, still they constitute an important feature in their history, and their special form and arrangement should always be carefully noted whenever they are seen, or can be exposed by the removal of a portion of the wall of the shell.

The late M. A. d'ORBIGNY stated that after having made reasonable deductions for the varieties due to age, sex, and pathological conditions, he estimated the number of Ammonites to amount to 530 species ; so that it is indispensable to classify them into groups in order to facilitate their determination. With this view, SOWERBY, in his Systematical Index of the Mineral Conchology, vol. vi., p. 249, divided the Ammonites into three sections—

- 1st Margin rounded,
- 2nd Margin flattened,
- 3rd Margin keeled,

the latter subdivided into (a) keel entire, and (b) keel crenated.

VON BUCH, in 1829, divided Ammonites into twelve groups, the characters of which were founded upon the external form and arrangement of the septa, which he had then just described for the first time. These groups are—

GROUP	EXAMPLE	DISTRIBUTION
1 ARIETES	<i>A. Bucklandi</i> , Sow.	Lower Lias
2 FALCIFORMIS	<i>A. serpentinus</i> , Schloth.	Up. Lias and Low. Oolites
3 AMALTHEI	<i>A. margaritatus</i> Mont.	Middle Lias and Oolites
4 CAPRICORNII	<i>A. Capricornus</i> , Schloth.	Middle and Upper Lias
5 PLANULATI	<i>A. triplicatus</i> , Sow.	Upper Lias and Oolites
6 DORSATI	<i>A. armatus</i> , Sow.	Lias
7 CORONARI	<i>A. Henleyi</i> , Sow.	Lias and Oolites
8 MACROCEPHALI	<i>A. Herveyi</i> , Sow.	Oolites
9 ARMATI	<i>A. Rhotomagensis</i> , d'Orb.	Cretaceous
10 DENTATI	<i>A. splendens</i> , Sow.	Oolitic and cretaceous
11 ORNATI	<i>A. Duncani</i> , Sow.	Oolitic
12 FLEXUOSI	<i>A. radiatus</i> , Brug.	Lower Cretaceous

M. A. d'ORBIGNY grouped Ammonites into 21 sections, founded upon the classification of VON BUCH, these are,

(A.)—*Species with an entire dorsal keel.*

SECTION	EXAMPLE	DISTRIBUTION
1 ARIETES, von Buch	<i>A. Bucklandi</i> , Sow.	Lower Lias
2 FALCIFORMIS, von Buch	<i>A. serpentinus</i> , Schloth.	Upper Lias
3 CRISTATI, d'Orb.	<i>A. cristatus</i> , Deluc.	Cretaceous

(B.)—*Species with the back channelled*

4 TUBERCULATI, d'Orb.	<i>A. auritus</i> , Sow.	Cretaceous middle
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(C.)—*Species with the back sharp without being in a keel.*

5 CLYPEIFORMI, d'Orb.	<i>A. Goupilianus</i> , d'Orb.	Cretaceous
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(D.)—*Species with the back prominent and crenulated on the median line.*

6 AMALTHEI, von Buch	<i>A. cordatus</i> , Sow.	Lias and Oolites
7 PULCHELLI, d'Orb.	<i>A. Brottianus</i> , d'Orb.	Lower Cretaceous
8 RHOTOMAGENSIS, d'Orb.	<i>A. Deverianus</i> , d'Orb.	Middle Cretaceous

(E.)—*Species with the back excavated, provided with tubercles on the sides.*

9 DENTATI, von Buch	<i>A. mamillaris</i> , Schloth.	Lower Cretaceous
10 ORNATI, von Buch	<i>A. Duncani</i> , Sow.	Middle Oolites

(F.)—*Species with the back more or less square.*

11 FLEXUOSI, von Buch	<i>A. radiatus</i> , Brug.	Neocomian
12 COMPRESSI, d'Orb.	<i>A. Beaumontianus</i> , d'Orb.	Cretaceous
13 ARMATI, von Buch	<i>A. perarmatus</i> , Sow.	Mid. & Up. Oolites
14 ANGULICOSTATI, d'Orb.	<i>A. Martinii</i> , d'Orb.	Lower Cretaceous
15 CAPRICORNI, von Buch	<i>A. Capricornus</i> , Schloth.	Lias and Oolites

(G.)—*Species with the back convex.*

16 HETEROPHYLLI, d'Orb.	<i>A. heterophyllus</i> , Sow.	Lias
17 LIGATI, d'Orb.	<i>A. ligatus</i> , d'Orb.	Cretaceous
18 PLANULATI, von Buch	<i>A. communis</i> , Sow.	Upper Lias
19 CORONARI, von Buch	<i>A. Blagdeni</i> , Sow.	Inferior Oolite
20 MACROCEPHALI, v. Buch	<i>A. coronatus</i> , d'Orb.	Neocomian and Oolites
21 FIMBRIATI, d'Orb.	<i>A. fimbriatus</i> , Sow.	Ditto

First Group, *ARIETES*, von Buch, 1829.

Ammonites with the shell in nearly all ornamented on the sides with simple radiating and projecting ribs; the back rounded, angular, or square, nearly always provided with a median keel, and a groove on each side thereof. Siphuncle in the keeled forms prominent, situated in the dorsal prominence. Mouth prolonged into a projecting process. Septa formed of lobes and saddles, with unequal ramifications. The dorsal lobe as deep as it is wide, and longer than the superior lateral lobes. The lateral saddle extending in general further forward than the others; the dorsal saddle very short. This group contains forms which are found only in the Lower Lias; the species are distributed, through the zones of *Ammonites planorbis*, *angulatus*, *Bucklandi*, *Turneri*, and *obtusus*, which they all well characterize.

The group *Arietes* is divisible into two sections.

(A.)—*Arietes* without a keel, including three well-marked species.

AMMONITES PLANORBIS, Sowerby.

" ANGULATUS, Schlotheim.

" SAUZEANUS, d'Orbigny.

(B.)—*Arietes* with a keel.

AMMONITES BUCKLANDI, Sow. AMMONITES OBTUSUS, Sow.

" CONYBEARI, Sow.

" BONNARDII, d'Orbigny.

" TURNERI, Sow.

" BROOKII, Sowerby.

" ROTIFORMIS, Sow.

" SEMICOSTATUS, Young & Bird.

" STELLARIS, Sow.

" BISULCATUS, Bruguière.

The Arietes without a Keel.

AMMONITES PLANORBIS, Sow. (Pl. i, Fig. 1.)

AMMONITES PLANORBIS, Sowerby, Mineral Conchology, p. 448, 1824.

" ERUGATUS, Young & Bird, Geol. of Yorkshire, tab. 13, fig. 13, 1829.

" PSILONOTUS, Quenstedt, Flözgebirge Württembergs, p. 127, 1843.

" PSILONOTUS LÆVIS, Quenstedt, Cephalopoden, p. 73, tab. 3, fig. 18, 1849.

" HAGENOWI, Dunker, Palaeontographica, p. 115, tab. xiii., fig. tab. xvii., fig. 2, 1846.

" PLANORBIS, Oppel, Juraformation, p. 73, 1856.

" PSILONOTUS, Quenstedt, Handbuch der Petrefactenkunde, p. 354, 1852.

" PSILONOTUS LÆVIS, Quenstedt, der Jura, p. 40, 1858.

" MACDONELLII, Portlock, Report on Londonderry, p. 134, Pl. xxix. A., fig. 12, 1843.

Shell smooth, discoidal, compressed; back rounded without keel, whorls four-fifths exposed, only slightly involute; surface of the thin test covered with fine hair-like lines of growth.

Dimensions.—Greatest diameter, 2 inches; height of the last whorl at mouth, seven-tenths of an inch; width, half an inch; whorls one-fifth involute.

Description.—This Ammonite is found nearly always crushed between laminae of shale; its natural form is therefore rarely seen, except in some Yorkshire specimens. It has a smooth discoidal shell, covered with fine, hair-like lines of growth, (pl. 1, fig. 1,) the back is round, and without a keel; the whorls, six in number, increase rapidly in diameter, and are four-fifths exposed, so that the whorls are only slightly involute. Dorsal lobe small, and little divided; superior lateral lobes long, five digitations; inferior lateral lobe shorter, three digitations; ventral lobes small, short, and few digitations. (Fig. 1, a, b.)

This species includes two well marked varieties, (a) *levis*, the form which I have figured and described, and (b) *plicatus*, which has ribs on the lateral parts of the whorls. This variety has been figured by SOWERBY, in the Mineral Conchology, as *Ammonites Johnstonii*; and by d'ORBIGNY, in the Paléontologie Française, as *A. tortilis*, (tab. 49,) and *A. torus*, (tab. 53.). It is described by QUENSTEDT, in his monograph on the Cephalopoda, as *A. psilonotus plicatus*.

A. Johnstonii has thirty short rounded ribs on the lateral sides of the whorls, that do not extend across the back, nor to the suture of the enveloped whorl. All the ribs completely disappear before they reach the back, which is smooth, rounded, and without the trace of a keel.

Affinities and Differences.—The character of the lobes connects this Ammonite with the group *Arietes* to which it is referred, but it wants the keel, dorsal furrows, and ribs, which distinguish most of the species of that group. The smooth forms exhibit sometimes folds on their sides, and these pass by insensible gradations into the ribbed varieties, which SOWERBY figured as *A. Johnstonii*, and d'ORBIGNY as *A. torus*; the absence of a keel, and the simplicity of the lobes, impart a peculiar character to this first Ammonite of the Lower Lias.

Locality and Stratigraphical Position.—I have collected *A. planorbis* in the first or lowest zone of the Lower Lias; wherever these beds are exposed it forms their most characteristic fossil. It is very abundant in the shales of this zone, at Bockeridge and Defford Commons, and at Binton, Wilmoote, and Grafton, Warwickshire; at Street and Uphill, Somerset; Penarth, Glamorgan; and at Pinhay Bay, and Uphill, near Lyme Regis, Dorset; where it is found in the upper part of the light-coloured

argillaceous limestone called White Lias. In the Yorkshire coast it is found in large water worn boulders at Robin Hood's Bay; the best specimens I know have been obtained from these blocks, in which it lies in clusters. The beds from whence these boulders have been detached are out at sea, as the rock is not found in situ at low water mark.

AMMONITES ANGULATUS, Schlotheim. (Pl. 1, fig. 4, *a, b*, fig. 5.)

AMMONITES ANGULATUS, Schloth., Petrefactenkunde, p. 70, 1822.

" **REDCARENSIS, Young & Bird,** Geol. Survey, Yorkshire Coast.

" **ANGULIFERUS, Phillips,** Geol. of the Yorkshire Coast, p. 192,
vol. 1, tab. 13, fig. 19., 1829.

" **COLUBRATUS, Zieten,** Versteinerungen Württembergs, tab. 3,
fig. 1, p. 3, 1830.

" **CATENATUS, d'Orb.,** Pal. Fran. ter. Jura, tab. 94, p. 301, 1842.

" **MOREANUS, d'Orb.,** " " tab. 93, p. 299, 1842.

" **CHARMASSEI, d'Orb.,** " " tab. 94, p. 296, 1842.

" **LEIGNELETHI, d'Orb.,** " " tab. 92, p. 298, 1842.

" **ANGULATUS, Quenst.,** Cephalopoden, p. 74, pl. iv., fig. 2, 1846.

" **ANGULATUS, Quenstedt,** Petrefactenkunde, p. 354, tab. 27,
fig. 7, 1852.

" **ANGULATUS, Quenstedt,** der Jura, p. 43, tab. 3, fig. 1, 1858.

" **ANGULATUS, Chapuis et Dewalque,** Fossiles de Luxembourg,
p. 36, pl. iv., fig. 1, 1853.

" **REDCARENSIS, Simpson,** Fossils Yorkshire Lias, p. 100, 1855.

Diagnosis.—Young shell compressed, whorls involute, half enveloped; sides with numerous, 26 to 30, sharp, simple, flexed ribs, which pass round the dorsal border, and terminate abruptly in a furrow in the centre of the back, or in a smooth truncated surface.

Adult shell, seven inches in diameter, compressed; whorls flattened, sloping towards the back; sides smooth, with long, faint, biflexed ribs, and shorter and more marked ribs near the dorsal border; back narrow, round, smooth; aperture compressed.

Dimensions.—One of my largest specimens from Lyme Regis measures seven inches and two-tenths in diameter. Height of the last whorl near the mouth is two inches and six-tenths; width, one inch and four-tenths. Whorls one-half covered by the involution of the spire.

Description.—Like many other Ammonites, this species must be studied at different stages of growth, if we are rightly to understand its true characters. Up to about the diameter of an inch the whorls have from 25 to 30 sharp simple ribs, which terminate abruptly and form a marked angle on the back—hence the origin of the specific name; at a later

period the ribs divide, become less distinct, and the angle on the back disappears; in advanced age the sides are smooth, the back narrow, and without a keel or ribs.

Septa symmetrical (fig. 4 *b*) divided into five lobes, and six saddles formed of unequal parts; the *dorsal lobe* much shorter and broader than the superior lateral lobe, divided into two parts to half its length by the median line, and formed of two or three short branches on each side, and a terminal trifid digit. The *dorsal saddle* is much larger than the superior lateral lobe, and terminates in three festoons which divide into folioles. The *superior lateral lobe* has four small lateral digitations, and a terminal digit, which divides into three or four branches. The *lateral saddle*, about as large as the superior lateral lobe, terminates in one central, and two lateral festoons, the former with four, the latter with three smaller foliations. The *inferior lateral lobe* is oblique, with three or four lateral, and a terminal, sometimes bifurcate, digit. The *three auxiliary lobes* are placed very obliquely, and gradually diminish in size as they approach the umbilical angle.

In my large specimen the dwelling chamber consists of four-fifths of the last whorl, its sides are smooth, and slope towards the back, which is round and narrow, without the trace of a keel; there are from thirty to forty long faint biflexed ribs extending from near the suture to the back, and shorter intermediate ones springing from the bifurcation of the former. All the ribs become much stronger marked as they pass round the dorsal border, where they suddenly disappear.

Affinities and Differences.—This Ammonite belongs to the group *Arietes*, and to the section without a keel; in early life its strong, sharp ribs form an angle on the back, and the dorsal furrow which interrupts them (fig. 4 *a*) liken it to some Gault species, but adult shells can scarcely be mistaken for any other form associated with them in the Lower Lias (fig. 5.)

This Ammonite presents many varieties of form during different stages of growth, which, when studied *per se*, have been mistaken for distinct species, for it is now ascertained that *Ammonites Catenatus*, *A. Moreanus*, *A. Charmassei*, *A. Leigneletii*, of d'ORBIGNY, are all different varieties of *A. Angulatus*.

Locality and Stratigraphical Position.—I collected this species between Charmouth and Lyme Regis, in a dark shale below the gray concretionary limestone with a mamillated surface, which forms the base of the *Ammonites Bucklandi* beds, and in the same strata south-west of the Cob. The zone which it characterizes is of no great thickness in Dorsetshire, and this Ammonite is considered one of the rarest found on

that coast. In Gloucestershire I have collected small ribbed specimens from the lowest shales of the Fretherne section on the banks of the Severn, and it has likewise been found at Aust Cliff. In Warwickshire some fine specimens were obtained from the Harbury cutting of the Great Western Railway, near Southam, and many good fragments are still to be found on the spoil banks of that line. In Yorkshire it is found only in the lowest beds of Lias at Redcar, where it is very rare, and known to local collectors as *A. Redcarensis*. It is found in the same zone of Lower Lias near Portrush, on the north-coast of Ireland.

The varieties of this species figured by d'ORBIGNY were collected in France from the lowest beds of the Lias with *Gryphæa incurva*, Sow. ; at Pont-Auber, near Avallon, (Yonne,) and Champlong, near Semur, (Côte-d'Or.) ; at Jamoigne, (Luxembourg,) and in several places in Germany near Balingen, Degerloch, Stuttgard, and other localities. It everywhere characterizes beds which are interposed between the Planorbis and Bucklandi series.

AMMONITES BUCKLANDI, Sowerby. (Pl. 1, fig. 2, a, b.)

AMMONIS CORNU, Lister, *Conchili Angliæ*, tab. 6, p. 207, 1678.

AMMONIS CORNU STRIATUM, Lang, *Historia Lap.*, Fig. *Helvetiæ*, tab. 24, p. 95, 1708.

AMMONITES BISULCATA, Bruguière, *Encyclopédie Méthodique*, tom. 1., p. 39, 1792.

AMMONITES BUCKLANDI, Sowerby, *Min. Conch.*, tab. 130, p. 69, vol. 2, 1816.

" " *v. Buch*, *Berlin Akad.*, tab. 3, fig. 1. 1830.

" " *Zieten*, *Petrif. Würtemb.*, tab. 27, fig. 1, p. 35, 1830.

Shell discoidal, depressed ; whorls slightly involute ; sides convex and largely costated ; ribs thick, bent, remote, 24 in a whorl ; back flat, strongly carinated, with a deep furrow on each side of the keel ; aperture quadrato-hemispherical.

Dimensions.—Transverse diameter 9 inches ; height of the whorl at the aperture $2\frac{1}{2}$ inches ; width 3 inches ; whorls about one-fifth involute. Many of the large specimens from Keynsham and Lyme Regis measure 18 inches in diameter.

Description.—This Ammonite attains a gigantic size, it has a flattened discoidal shell, formed of six or seven slightly involute whorls, having the inner ones largely exposed ; the sides are convex, sub-cylindrical, and separated by a deep suture, having strong prominent ribs, about 24 in a whorl, which are rounded, distant, simple, arched, and terminate abruptly on the dorsal border where they are interrupted ; the back forms a broad flattened arch, and the middle line is occupied by a strong

thick keel, bounded on each side by a deep furrow; the aperture is rounded or sub-quadrangular.

The septa are symmetrical, divided on each side into three lobes and three saddles formed of unequal parts. The dorsal lobe is narrow, one-third longer, and a little wider than the supero-lateral lobe, and has on each side, five nearly equal sized serrated digitations. (Pl. 1, fig. 2, a.)

The *dorsal saddle*, one-fourth wider than the supero-lateral lobe, is divided into seven folioles of unequal sizes. The *supero-lateral lobe*, a little longer than wide, and has on each side three elongated foliated digitations. The *lateral saddle*, twice the size of the supero-lateral lobe, is formed of eight or nine subdivided lobules. The *infero-lateral lobe*, smaller than the supero-lateral, has four external and three internal digitations. The *auxiliary saddle* is small with five small lobules. The *auxiliary lobe* is small with three digitations.

Affinities and Differences.—This species was first described by M. BRUGUIERE in the *Encyclopédie Méthodique*, tom. 1, p. 39, under the name *Ammonites bisulcata*, the diagnosis includes two forms (A) *Ammonites Bucklandi*, Sow.; and (B) *Ammonites multicostata*, Sow.

(A) "*Ammonites costis simplicibus raris, dorso bisulcato carina acuta intermedia.*"

(B) "*Ammonis cornu spina in ambitu eminente, striis, lateralibus ex toto orbem extimum trajicientibus.*"

The variety *a* had been previously figured by LANG in his *Historia Lapidum Figuratorum Helvetiæ*, tab. 24, fig. 1, and described as "*Ammonis cornu striatum striis integris in spinam inter duos sulcos eminentem abeuntibus.*"

I propose to retain SOWERBY's name for var. *a*, and BRUGUIERE's name, *bisulcata*, for var. *b*, as the forms are very distinct and readily distinguished from each other. *A. multicostata*, Sow., will then be a synonym of *A. bisulcata*, Brug.

Ammonites Bucklandi has 24 ribs, which gradually disappear on the dorsal border, and there are no tubercles near the angle of the sulci.

Ammonites bisulcata has a quadrate angular form, with from 34 to 36 costæ, with a tubercle on each rib near the angle of the dorsal border, from whence the ribs curve forward into the sulcus.

There is no other form in the Lower Lias, for which *A. Bucklandi* can be mistaken.

Locality and Stratigraphical position.—*Ammonites Bucklandi* characterizes an important zone of life in the English Lias, the stratigraphical relations of which are best exposed in the magnificent coast section, near Lyme Regis. I have collected this Ammonite likewise

at Fretherne Cliffs, on the banks of the Severn, and found fragments of it in the Lower Lias Limestones of the counties of Somerset, Gloucester, Worcester, and Warwick. The finest specimens I have found were on the coast near Lyme Regis, and in the Lower Lias, at Keynsham, near Bath; the specimen figured was obtained from a railway cutting in the Lower Lias, near Brigg, in Lincolnshire.

AMMONITES BROOKII, Sowerby. (Pl. 2, fig. 5.)

AMMONITES BROOKII, Sowerby, Min. Conch., vol 2, tab. 190, p. 203, 1818,

" " Zieten, Petrif. Würtemb., tab. 27, fig. 2, p. 36, 1830.

" " Oppel, Juraformation, p. 83, 1856.

" " Simpson, Yorkshire Lias, p. 97. 1855.

Shell depressed, strongly carinated, with a deep narrow sulcus on each side of the keel; whorls costated, with 36 strong, simple, arched, ribs, which curve round the inner margin of the whorl, and terminate at the sulcus; whorls half involute, inner volutions well exposed; surface of the shell marked with fine flexed lines of growth; aperture oblong.

Dimensions.—Transverse diameter $5\frac{1}{2}$ inches; height of the outer whorl at the aperture $2\frac{2}{5}$ inches; width $1\frac{1}{2}$ inch; amount of involution one half the whorl.

Description.—This handsome, well-marked species is recognized by its compressed shell, ornamented with strong, simple, arched ribs, that are large and prominent, and equal in width to the valleys between them; the ribs curve round the inner margin of the whorl, arch regularly forwards, and terminate at the dorsal angle of the outer margin of the sulcus; the back is sharp and angular; the keel round and prominent, with a deep furrow on each side, forming a well-marked boundary between the keel, back, and sides. The surface of the shell is marked with fine flexed lines of growth, corresponding in flexure with those of the costæ; the siphuncle is lodged in the strong round keel.

Affinities and Differences.—This fine, boldly marked shell so much resembles *A. Turneri*, Sow., that it is difficult to discover the points of difference between them, whilst the affinities are numerous. In *A. Turneri* the shell is thicker and more quadrate, the back broader, the ribs are nearly straight to the upper third of the whorl, where they bend abruptly forward towards the aperture, and form a kind of thickened eminence at the angle of flexure. In *A. Brookii* the upper third of the whorl slopes off, and the costæ, which are not so numerous, arch more regularly forward, forming the angle of flexure found in *A. Turneri*. This point of difference may be only one of sex, for SOWERBY says in his description of *A. Turneri*,—"The more exposed whorls, squarish aperture, and

differently curved radii, distinguish this from *A. Brookii*, to which it bears a strong resemblance." If a larger series of both forms could be obtained, it is probable it would be found that they merged into one species; but, for the sake of convenience and easy reference, until more facts are brought to light, I have thought it best to figure on the same plate a good type form of each, from which it will be seen that the affinities are many, and the differences few and immaterial.

Locality and Stratigraphical Position.—*Ammonites Brookii* is found at Lyme Regis in fine preservation, with the shell complete, in beds of Lower Lias Limestone; sometimes it is enclosed in crystalline masses of the Sulphuret of Iron. It is on the whole a rare Ammonite.

AMMONITES SAUZEANUS, *d'Orbigny*. (Pl. 2, fig. 1, *a, b, c, d.*)

AMMONITES SAUZEANUS, *d'Orbigny*, Palæontologie Française Ter. Jur., Pl. 95, fig. 45, p. 304.

" " *Wright*, Monograph on the Asteroidea, Pal. Soc. vol. 1862, p. 22.

" *HALECIS*, *Buckland*, Murchison's Geol. of Cheltenham, Pl. 11, fig. 9, p. 104.

Shell compressed, whorls quadrate, one third involute and ornamented with twenty costæ; the ribs are slightly bent, the convexity backwards, and they terminate in a tubercle at the dorsal angle; back flat with an elevated central ridge.

Dimensions.—The large specimen, transverse diameter 8 inches, height of aperture $2\frac{7}{8}$ inches, width of aperture $2\frac{1}{8}$ inches.

Description.—This remarkable Ammonite has an extremely quadrate physiognomy, the whorls about one third involute, are square and ornamented in the large specimen figured with twenty ribs, which are simple, slightly bent with their convexity backwards, and terminate at the angle of the back in small well-marked tubercles, Pl. 2, fig. 1. The back is large and square, an inconsiderable eminence rises in the middle line, which, however, does not form a keel, nor are there any traces of lateral sulci as in the true keeled *Arietes*. The spire, formed of square shaped whorls, imparts a stair-like character to the open umbilicus. The mouth is quadrate, the width slightly exceeding the height, the septa are symmetrical, foliated on each side, and divided into four lobes with narrow branches; the dorsal lobe (fig. 1, *c.*) long and narrow, projects beyond the others, the outer side has three short simple, two long branched, and one terminal branched digitation; on the inner side of each bilateral segment of the lobe there are five or six simple

digits. The superior lateral lobe is small, it has five or six long tooth-like lateral digitations on its outer, three or four on its inner side, and bifurcates into two terminal branches; the inferior lateral lobe is long and slender, with several narrow digitations on the sides, and a bifurcate termination; the auxiliary lobe is small; the dorsal saddle is large, but is not sufficiently exposed for accurate description; the lateral saddle is very large, occupying two-thirds of the sides of the whorl, it has two large terminal folioles, and two lateral folioles, with four or five lobules in each.

Affinities and Differences.—In the quadrate outline of its whorls and its straight simple ribs it resembles *A. Valdani*, d'Orb.; and the terminal tubercle on its ribs likens it in form to *A. perarmatus*, Sow.; whilst the form of the lobes and saddles, and the median ridge on the back distinguish it from both. It is very distinct from the other two species of keelless *Arietes*, and has no affinities with the keeled species of that group, the absence of the dorsal sulci affording a reliable diagnostic character.

Locality and Stratigraphical Position.—The large specimen was collected in the zone of *Ammonites obtusus*, near Bredon, during the construction of the Bristol and Birmingham railway. The smaller specimen was obtained from the same zone at Darlingscott, near Shipton-on-Stour, and given me by my friend JOHN KIRSHAW, Esq., of Warwick. I have found one or two small specimens in the Lower Lias of the Vale of Gloucester, and my friend, R. ETHERIDGE, Esq., F.G.S., collected a specimen from the railway cutting, at Horfield, near Bristol.

Ammonites Sausseanus is a very rare *Ammonite* in France, M. d'ORBIGNY states that he had seen only two specimens of this singular species, which were collected from the *Gryphaea arcuata* beds of the Lower Lias, by M. BOUCAULT, at Champlong, near Semur, (Côte d'Or,) where it is very rare.

AMMONITES TURNERI, Sowerby. (Pl. 2, fig. 4, a, b.)

AMMONITES TURNERI, Sowerby, Mineral Conchology, tab. 452, vol. v., p. 75., 1825.

Shell discoidal, depressed, strongly carinated, with a deep narrow sulcus on each side of the keel; whorls costated, with 42 strong, simple, straight ribs, which bend suddenly forward near the back, each rib thickened at the angle; whorls one-half involute, inner volutions well exposed; aperture oblongo-quadrate.

Dimensions.—Transverse diameter $4\frac{1}{2}$ inches; height of the aperture $1\frac{6}{10}$, width $1\frac{1}{10}$ inches; amount of involution nearly one-fourth of the whorl.

Description.—This shell so closely resembles *Ammonites Brookii*, that I have long suspected it might only be a variety of that species, the want, however, of a good series of specimens of *A. Turneri*, to enable me to compare it with *A. Brookii* in different stages of growth, has induced me to retain, for the present, SOWERBY'S name, and give his description of *A. Turneri* from the vol. v., p. 75 of the Mineral Conchology. "Depressed, radiated, carinated, a furrow on each side of the keel; inner whorls exposed; radii numerous, equal, curved towards the front; aperture oblong-quadrangular. Volutions about five, the inner ones almost wholly exposed; the radii are almost straight until they are rather suddenly bent towards the front; the aperture is less than one-third of the diameter of the last whorl in length. The more exposed whorls, squarish aperture, and differently curved radii, distinguish this from *A. Brookii*, to which it bears a strong resemblance."

The septa are very imperfectly preserved in the specimen I have figured, Pl. 2, fig. 4, *b*, represents the dorsal lobe, which is narrow, and nearly as long as the super-lateral lobe. Fig. 4, *b*, the artist copied from QUENSTEDT'S tab. 3, fig. 19, *a*; but as this is a young *A. obtusus*, and not *A. Turneri*, as that author supposed, it does not help us in this critical enquiry.

Affinities and Differences.—The affinities of *A. Turneri* with *A. Brookii* are so numerous, and the differences between them so few and inconsiderable, that I consider the question of their specific identity one which requires further consideration; the affinities are more fully pointed out in the description of *A. Brookii*.

Locality and Stratigraphical Position.—The specimen figured was collected from a light-coloured clay and limestone in the deep cutting of the Bristol and Birmingham railway, near Bredon, associated with *A. Bonnardii*, d'Orbigny, *A. semicostatus*, Y. & B., and several other mollusca, with many fragments of the stems and side arms of *Pentacrinus tuberculatus*, Miller, and *Cidaris Edwardsii*, Wright.

AMMONITES BIECHII, Sowerby. (Pl. 1, fig. 3, *a*, *b*.)

AMMONITES BIECHII, Sowerby, Min. Conch, vol. 3, p. 121, Pl. 267, 1820.

PLANITES " Haan, Amm. el Gon., p. 82, No. 2, 1825.

AMMONITES " Quenstedt, Cephalopoda, p. 86, 1849.

" " d'Orb., Pal. Fran., ter. Jurassique, p. 287, Pl. 86, 1842.

Shell compressed, back rounded without a keel; whorls numerous, narrow, slightly involute, sub-rotund; sides compressed, with numerous thick obtuse costæ, two tubercles developed on each, which are sharp in young, and blunt in old shells; aperture rotund with flattened sides.

Dimensions.—Transverse diameter of a large specimen 8 inches ; height of the aperture $1\frac{1}{2}$ inches ; width $1\frac{1}{10}$ inches.

Description.—This very distinct and characteristic Ammonite of the Lower Lias is readily distinguished by the round back and bi-tuberculated ribs.

The whorls increase so slowly in diameter, that in a large specimen before me, eight inches in diameter, there are seven turns of the shell ; the sides of the whorls are convex, and slightly flattened in the middle, they have from 32 to 34 thick, straight, lateral costæ, with two tubercles developed on each, the outer is the largest, and in some specimens becomes spinous ; the inner is smaller and more obtuse, and the costæ disappear near its inner border.

The back is round, and in some specimens three or four fine transverse bands extend across the back from one outer tubercle to the other, and fine transverse lines of growth are seen on the shell figured in Pl. 1, fig. 3.

The spire is formed of very narrow whorls, which are slightly involute and fully exposed.

The aperture is round above, flattened on the sides, and very little diminished by the turn of the spire.

The septa are symmetrical, and have an extremely complicated arrangement of lobes and saddles, of these I am only able to figure a portion. The dorsal lobe is nearly as long as the laterals, fig. 3, *a*, it is deeply bifid, and on each side thereof are six or seven long narrow digitations. The superior and inferior lateral lobes have an exceedingly complex arrangement in the distribution of their side branches, this will be much better understood from the excellent figure I have given of them than by any verbal description thereof. The saddles consist of numerous slender foliations.

This species preserves its specific form through life, with only a very limited variation ; the fry, up to half an inch in diameter, are smooth, the outer tubercles are first developed, and the inner ones soon follow, so that when the shell attains one inch in diameter, it exhibits the distinguishing characters of the species, which are steadily preserved in my largest specimen, eight inches in diameter.

Affinities and Differences.—This Ammonite is very distinct from all its congeners in the Lower Lias, and is easily identified by its round back, slow increase in the diameter of the whorls, the bi-tuberculated character of its numerous costæ, and complex ramifications of its septa, —by these characters it is easily distinguished from them.

A. Valdani, d'Orb., of the Middle Lias, has likewise bi-tuberculated costæ, but the flatness of this shell, and the elevated median ridge on its

back, with the simpler character of its lobes, and the great size of its saddles, serve to distinguish it from *A. Birchii*.

Locality and Stratigraphical Position.—The finest specimens of this shell are found near Charmouth and Lyme Regis, in the zone of *A. obtusus*, associated with *A. Brookii* on the same slab, and with the large Saurians, *Ichthyosaurus platyodon* and *Ichthyosaurus intermedius*. It is rare in Gloucestershire, although I have several specimens which were collected from the railway cutting near Bredon; one of these specimens shewed the arrangement of the septa figured at fig 3 a.

(*To be continued.*)

Notes on the Ancient Crosses of Gloucestershire, continued. By CHARLES POOLEY, Esq., of Weston-super-Mare.

CLEARWELL—AYLBURTON—LYDNEY.

No record is known to exist concerning these fine old Crosses, nor does a fragment of the capital of either of them remain to suggest even their origin. They may have been put up to commemorate some particular event, or to serve as sacred centres, around which the simple and unlettered people assembled to hear the preaching of the monks, or they may have been built to perpetuate the claim which certain abbeys or religious fraternities had to privileges and grants in the forest. But whatever their object, as symbols of the Christian's hope, their presence could not be without some softening influence on the minds of the rough foresters, who, as the merchants of Tewkesbury knew to their cost, were none of the most amenable to the civil power.*

Although no fixed date can be assigned to the period of their erection, these Crosses may be said to belong to the latter part of the fourteenth century. Ecclesiastical architecture had already undergone a transition, the semicircular having given place to the pointed arch, but the art had not yet attained to that more perfect or florid development of decoration found in works of a later date. And thus it is, that while in one of these, (Clearwell,) the attempt is made to follow the rule of early Gothic throughout,—the span of the arches being supported by well proportioned angle shafts, with caps and bases; the spandrils carved, the arches trefoil-headed with double cusplings, and the mouldings in unison with the style; in Aylburton there is a capriciousness in the style, a union of the Classical with the Christian:—the vigorous, deep, horizontal mouldings

NOTE.—For the measurement of these Crosses, as well as for several notes and suggestions, I am indebted to our colleague, J. D. T. NIBLETT, F.S.A., to whom I beg to tender my best acknowledgments.

* Petic : in parl. 8 H.—VL, quoted by FOSBROOKE.



CLEARWELL CROSS



Engraved by J. G. S. J. G. S. J. G. S.

Engraved by J. G. S. J. G. S. J. G. S.

AYLBURTON CROSS.

contrasting strongly with the timidly executed featherings of the Gothic arch, and blank spandrels, while the buttments and facing of the work are of Doric simplicity. And may not this discrepancy even point to different architects;—Aylburton representing that mixed style, the product possibly of an Italian artist, who, familiar enough with the classic forms of his own country, was not so confident in his knowledge of Gothic lines as to permit him to do more than make an effort to imitate in the arch the leading features of its construction; and Clearwell illustrating the work of a more accomplished hand, one acquainted with the theory and practical development of early Gothic; for be it remembered, at this period, and long before, it was the custom to bring over foreign architects, or *master masons*, as they were termed, as well as workmen, and these people were much employed in the service of the church.

These Crosses are all built of the same grey forest stone, and consist of a sort of square shrine, having a niche, once probably containing sculptured figures, uncanopied, in each of its four sides. This building forms the pedestal to the Cross, and is placed on the summit of a flight of steps, called, in the language of ecclesiastical analogy, the *Calvary*. Of these steps and pedestals the following are the comparative dimensions :—

	Extreme width at Base	No. of Steps.	Height of Top Step from Ground.	Height of Pedestal of Cross only.	Width of Base of Pedestal	Total Height from Ground.
	ft. in.		ft. in.	ft. in.	ft. in.	ft. in.
Lydney	24 3	8	8 6½	8 7	5 3	17 1½
Aylburton ...	14 2	5	6 10	9 2	3 9	16 0
Clearwell ...	14 11	5	5 4	7 6	2 8	*15 3

On the top of Clearwell pedestal is a block of squared masonry, in which is inserted what remains of the shaft. The baldness of this block mars the outline of the whole, and conveys the impression that the original, which was doubtless designed in accordance with the same style of architecture as the pedestal, has been broken down, and this put up as a substitute. Since the photograph was taken from which the plate is engraved, a supplementary piece of stone has been clumsily grafted on the stump of the original shaft, and this again surmounted by a cock, with bright red comb and wattles, "which," as Mr. NIBLETT observes, "does not turn with the wind, as a right-minded cock should do; but, pugnacious as a Celt, bristling like the Forest-grown holly, ready to do battle with intruders, stands obstinately fixed with his beak pointing to a certain mansion hard by."

* To the latter of these, however, must be added 3ft. 7in. of the original shaft still in existence, which gives an amended total of 18ft. 10in.

"And" continues Mr. NIBLETT, "hereby hangs a tale. The lady proprietor of the said house, whilst employing a London architect upon her mansion, commissioned him to take careful admeasurements of the Cross, in its present mutilated state, with the idea of making a skilful restoration of it. On seeing the building so carefully measured, an idle rumour got afloat amongst the villagers, to the effect that the old Cross was going to be pulled down and removed altogether. Meetings were consequently held, and a chairman duly elected, and it was decided that a long stone, prepared for the express purpose by a respected inhabitant named Yarworth, who had died 20 years previous, should be set up, and it is set up accordingly in the wondrous fashion above described. Had it not been for the mysterious use of tape and rule this agitation would never have been got up, and Yarworth's monolith, so carefully singled out of the quarry by him for its apt proportions, would have lain there still for another twenty years, or, perhaps, for ever."

In Aylburton Cross, which was repaired about A.D. 1841, the plinth, or socket, at the top of the pedestal, is ornamented with a drip moulding, which gives a finish to the proportions of this member of the building, and a finer and more harmonious effect than is produced by the bald block of Clearwell.

Of Lydney Cross there is not much to be said. From the size and loftiness of the steps, it may easily be conceived what a handsome and imposing structure it once was, and how it must have towered above all around it. I happened to visit this Cross soon after it had been mended, when the mortar was fresh in the joints, and the scraping and chiselling had left a clean surface behind. The principal mischief may have been done earlier, but a glance at the plate, which is a *fac simile* of a photograph taken at the time, will convey to the reader, better than words can, an idea of the aspect it then had, which is in no respect calculated to exalt our ideas of the "Transition Decorated," if, in its present condition, the Cross is to be considered as a specimen of that style.

It was a common custom to decorate the capitals of Crosses with sculpture, or with canopied niches, containing figures,—the Cross proper, usually of iron, surmounting the whole. Not only High Crosses, but Way-side, and even Church-yard Crosses, and slender monoliths of 10 or 12 feet in length, and of hard stone, were thus ornamented; and from the size of the shaft, I think it not improbable that these were similarly crowned. But I shall allude more fully to this subject when touching on the general history of Crosses.

In conclusion, we cannot look on these buildings without interest.



HEBNEY CROSS

From the South to the Church

They are relics of an age when Gloucestershire stood pre-eminent amongst other counties for its godliness ; when its abbeyes, churches, priories, oratories, preceptories, cells, and other religious foundations, betokened a Christian zeal, so deep and wide-spread, that men were accustomed to give strength to an affirmation by saying, "As sure as God is in Gloucestershire." They are still preserved to us, mutilated it is true, but may there not be yet latent some portion of this traditional piety, in the respect observed towards these ecclesiastical monuments, and which, perhaps, may have contributed in a degree, however small, to preserve them from utter destruction.*

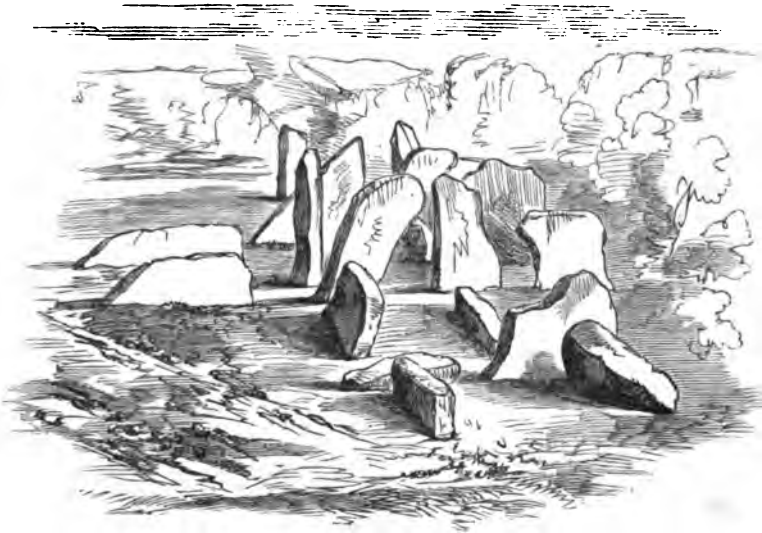
* An amusing instance of this veneration for an ancient cross recently occurred in the pretty village of Crosscombe, near Wells. In the village stands an old grey-stone market cross, which the local way-wardens, deeming an incumbrance, endeavoured to remove. It seems the removal of so ancient a landmark, in the historical associations of the village, proved a graver and more serious matter than these enlightened wardens of the way were aware of. The inhabitants gathered around the old cross, and came to its defence, with bold and determined hearts, bent upon its preservation, but not before the shaft had been hurled to the ground, and its finial broken in twain. The demolishing party having been driven off, a flag was hoisted by the brave villagers, bearing upon it the legend "Be Faithful ;" this was struck down during the *mêlée*, but as quickly regained, and the Standard of the Cross again waved proudly over the heads of the loyal defenders. To such a pitch of earnestness was the defence carried on, that upwards of thirty stout fellows volunteered to bivouac round the sacred symbol, and guard it during the night ; while women were actively engaged in preparing beds of straw and kindling a huge fire, to make the hours pass away as agreeably as possible.

Notes on an Ancient British Tumulus at Nympsfield, opened by the Cotteswold Club. By JAMES BUCKMAN, F.G.S., F.L.S., F.S.A., &c., Professor of Botany and Geology.

THE Barrow at Nympsfield, which was opened by the members of the Cotteswold Club in August, 1862, presents so many points of interest that I venture to lay before you a short description of our proceedings, to which, through the kindness of Dr. THURNAM, I am enabled to add some valuable Notes on some of the skulls which were submitted to his examination.

The Tumulus is situated on an eminence known as Crawley Hill, at a distance of about half a mile to the north of that of Uley, which latter was opened in the year 1821, and re-opened in 1854, under the direction of Mr. E. A. FREEMAN and Dr. THURNAM.*

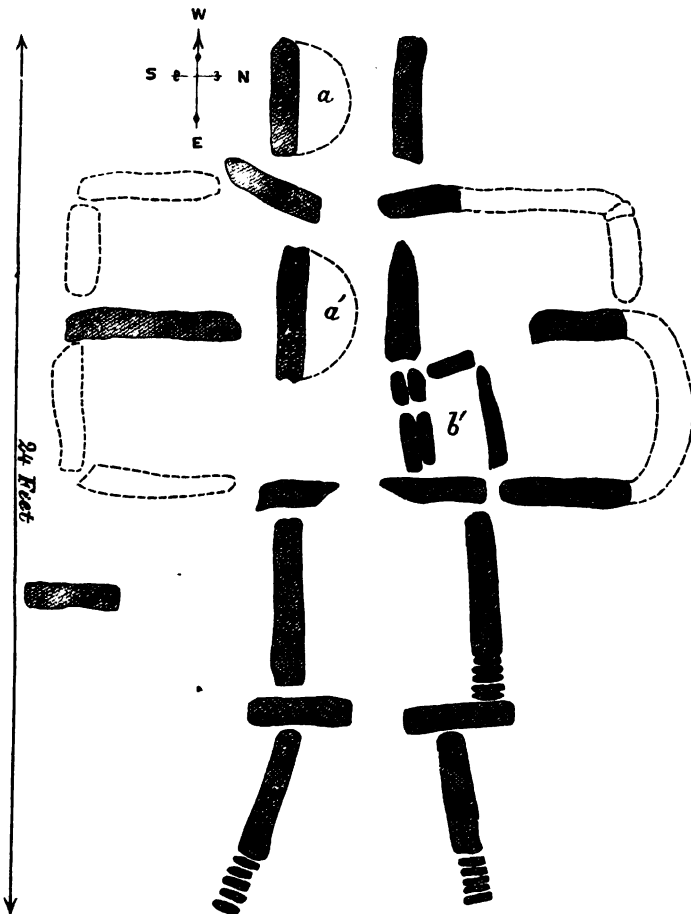
The Nympsfield Tumulus appears to have been opened on a former occasion, so that on being re-opened, it was presented to the Club in a much less perfect condition than that near Uley-Bury, if indeed, it was ever quite so complete; still the plan of the two is so exactly identical, that there can be little doubt but that both were the work of the same period and people. The following sketch of the former is by Sir GARDNER WILKINSON.



* See the full description of the Uley Tumulus by J. THURNAM, M.D., F.S.A., in the *Archæological Journal*, Vol. xi., p. 313.

The Tumulus in both is of an ovoid form, and in each the broad end where the chamber was situated, is to the east, and the small one to the west; the one near Uley-Bury, which is 120 feet in length, and 85 feet in its greatest breadth, being a few feet longer than that at Nympsfield.

On exposing the chambers in the Nympsfield Tumulus, it was at once seen that the upright stones marked more or less perfectly a central passage with one or perhaps a double set of cruciform or lateral chambers on either side; in the first of which on the north side was partitioned off a smaller chamber or cist, probably to receive some infantile remains, as such were found therein. (See Ground Plan, *b'*.)



In certain parts, the spaces between the uprights and the walls of the entrance were made up of dry walling, as shown on the plan.

So far then this is almost identical with the plan of the chambers at Uley, but the latter will be found to have fine slabs of stone placed roof-wise on the tops of the upright stones; a feature, which if ever present at Nympsfield, as probable, must have been destroyed at some previous opening.

In both cases the work appears to have been commenced on the surface of the hill, with probably only just a sufficient trench to enable each stone to be kept upright. Both hills offer examples of the upper beds of the Inferior Oolite; but in both cases, the stones used in constructing the chambers consist of the lower freestones of the Great Oolite, which, in all probability were quarried for the purpose at a distance of about half a mile to the north-east of the Nympsfield Tumulus, at a place called "Stone Hill." These stones had but little, if any, fashioning, but their plank-like slabs varied to sizes of,—for the uprights, 5 feet square to 1 foot thick; for the roofing slabs at Uley, 6 or 7 feet square.

It would appear that when the chambers were completed, and the bodies placed in them, a stone roof was placed over the whole, and then that the loose stones, earth, etc., were piled upon and over the whole, so as to form the tumulus; this method necessitating the construction of a slight fosse, which is observable surrounding the tumulus, especially in that of Uley.

In the Nympsfield one this fosse is not so observable, probably from the field having been for so long under the plough. Here, too, there was a deep depression in the top of the mound, most likely left after the former opening.

The contents of the Nympsfield chambers, comprise—

- I. Human bones; a few of which had been burnt.
- II. Bones of Inferior or Domestic Animals.
- III. A small fragment or two of Pottery.
- IV. A few flakes of Flint.

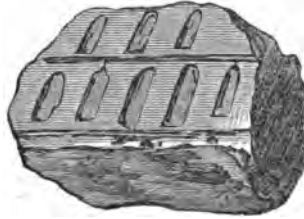
I. As regards the human remains, it was deduced from thirty-two *femora*, which were counted by Dr. BIRD, that the chambers, in the state in which the Club examined them, presented evidences of the remains of at least sixteen human bodies.

These varied in size and in age from very old to young men and women, with a few remnants of the bones of children; so that whatever may be true as regards other Tumuli of this period having been erected in honour of a chieftain, here it seems quite certain that we have the remains of a family or a tribe.

Portions of as many as ten or twelve skulls were sent to Dr. THURNAM, and his report upon them will follow this paper. It may not, however, be out of place here to mention that his observation of "a greater number of the teeth, namely two or three incisors and two or three molars, have been lost during life in the case of the most perfect of the Nympsfield skulls than in almost any other British skull he has examined,"* is curiously confirmed as to the rough usage some at least of the occupants of these chambers must have received, by the finding of a portion of a rib whose overlapping ends proclaimed a former fracture. "Two vertebræ were anchylosed," says Dr. PAYNE, of Stroud.

II. The Bones and Teeth of inferior animals comprised not a few remnants of the Ox, Hog, Dog, and Birds. Some, at least, of these creatures were the undoubted food of the ancient Britons; and it is conjectured, from the want of horizontality in the worn down human teeth, that animal food was indeed their chief subsistence.

III. The small fragment of Pottery is of the usual brownish or black unbaked clay of the period. This fragment is scored with the peculiar

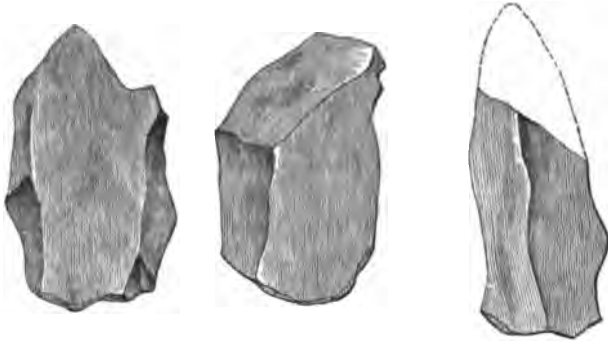


impressed marks so common in ancient British *fictilia*. It is curious that only two small bits of Pottery should have been found. Is this to be attributed to such matters having been taken away at the former exhumation? In the Tumuli of Wiltshire, when they have not been rifled, some very fine urns often occur. Some of these are now to be seen in the possession of Mr. CUNNINGTON, of Devizes, whose grandfather, in conjunction with Sir R. C. HOARE, opened so many barrows in the rich archaic county of Wilts.

IV. The Flint flakes, though in themselves so insignificant, are yet important to observe, as Nympsfield is quite out of the way of the Flint drifts; and again, rude as are our specimens, I have no doubt that they got their present form by artificial means, and are either flakes

* I do not suppose the teeth have been knocked out, but lost from caries, abscess, or other disease. (J.T.)

chipped off in making more important implements; or were themselves designed to be completed for arrow-heads, rude knives or the like, or even used as such in their present form.



Sir RICHARD HOARE, in speaking of the Barrows of North Wilts, which I think were intimately connected with our Cotteswold examples, says that he found in them "no costly ornaments of jet, amber, or gold," such as "so often had rewarded his labours in the southern district of the county," and he hence draws an inference as to the "very high antiquity" of the Tumuli near Avebury, and also as to the "poverty" of the clan of Britons who inhabited these downs.*

Both North Wilts and this Hill-district of Gloucestershire were peopled by the *Dobuni*; and as Dr. THURNAM attributes the skulls from Uley, and some from West Kennet, in North Wilts,† to a very early pre-Roman period, we may probably assign to the same period the remains I have been describing.

* Quoted from a Paper on the Barrows of North Wilts, by Dr. THURNAM, in the *Wills Archaeological and Natural History Magazine*, 1860, vol. vi, p. 317.

† The West Kennet Chambered Barrow and Skulls are described in *The Archaeologia*, vol xxxviii., p. 405; and in *Crania Britannica*, Decade V. pl. 50.

Report on the Skulls from the Tumulus at Nympsfield.

By JOHN THURNAM, M.D., F.S.A.

THE osseous remains from the Chambered Tumulus of Nympsfield consist of one skull, one broken calvarium, and fragments of at least ten other crania.

No. 1. The large and finely developed skull of a man of middle age. Its capacity is represented by eighty-eight ounces of white sand, and the contained brain must have weighed about fifty-eight ounces avoirdupois. The type is dolichocephalic, with a full and prominent occiput. The only exception as to equable development depends on the presence of slight parieto-occipital flatness. The frontal region is rather narrow, but is moderately elevated and well arched where it joins the parietals. The parietal tubers are not prominent. The superciliaries are large, and form a central overhanging boss. The nasals are broken off at the roots. The superior maxillaries are short, especially the alveolar portions; as in other skulls from the chambered tumuli of Uley and West Kennet. Slight prognathism is exhibited in the prominence of the intermaxillaries. A greater number of the teeth, viz., two or three incisors and two or three molars, have been lost during life than in almost any other British skull I have examined. One molar and two premolars are in place; they are very much worn down, and have the dentine hollowed out. There is no lower jaw among the fragments which can be confidently attributed to this skull.

No. 2. A broken calvarium of still more decidedly dolichocephalic character than the skull No. 1. In this instance likewise, the supra-occipital region is full and prominent. Behind the coronal suture is a marked depression, which extends down the sides of the skull, and suggests the idea of having been produced by the long continued use of a constricting bandage in early life. This peculiarity of form is one occasionally observed in ancient British skulls, and especially in those from the north of Wiltshire and Gloucestershire, the country of the *Dobuni*, as seen in many crania in my collection.

Nos. 3, 4, and 5. Frontal bones; all apparently of male skulls. They are characterized by their generally low, narrow, and receding form; as is likewise the frontal bone in the calvarium No. 2. This form prevails

especially in skulls from the chambered long-barrows of Wilts, Gloucester, and Somerset. (See the description of the skull from Uley, in *Crania Britannica*, Plate 5.)

No. 6. Frontal and facial bones and lower jaws (all imperfect) of a female, probably of less than thirty years. The form is in no respect peculiar, except that the lower jaw is square and angular. The teeth are considerably eroded.

No. 7. Fragments of the frontal and facial bones of a male of about forty years.

No. 8. Upper maxillaries of, perhaps, a female, of about sixty years.

No. 9. Left upper maxillary of a male of about forty years.

No. 10. Left upper maxillary of a young adult, with two molar teeth, showing incipient attrition on the inner edges.

No. 11. Part of inferior maxillary of an infant, with two deciduous teeth in place.

No. 12. Fragment of lower jaw of an aged female, completely edentulous.

The fragments of two lower jaws of males, marked A and B, show in a high degree the broad and angular form of the ascending ramus, which is so marked a feature in the adult male British cranium.

There are several fragments of burnt human bones, the largest being part of the occiput of a child. They are very imperfectly burnt, many of them merely charred, and are very different from the cinders of bone found when unambiguous cremation has been practised.

DEVIZES, Sept. 1862.

On the position of Gryphæa incurva in the Lower Lias at Bridgend.

TO THE HON. SECRETARY OF THE COTTESWOLD NATURALISTS' FIELD CLUB:

My dear Sir,

I feel it due to the Club, and to myself, to bring before it the result of some correspondence between myself and Mr. CHARLES MOORE, of Bath, in reference to the vertical distribution of *Gryphæa incurva* in English Liassic beds. It will be seen at page 93 of the letter-press of my communication upon that species, that upon the authority of Mr. R. TOMES, of Welford, I figured in plate 1, figs. 55 and 56, a specimen which that gentleman sent to me from what he considered to be the White Lias of Bridgend, in Glamorganshire. As stated distinctly by me, I adopted the specimen and its alleged stratigraphical position entirely upon Mr. TOMES's authority. Mr. MOORE, to whom I sent a copy of the publication, informed me that I was entirely in error upon this point, as the beds at Bridgend were well known to him; that they consisted entirely of those which constitute the *Lima* series, and that the White Lias was nowhere developed in that neighbourhood. As the point in dispute lay entirely between him and Mr. TOMES, I referred each to the other, and they agreed, with a persistency in the cause of truth which we must all admire, to meet and discuss their differences upon the ground.

Mr. TOMES said that the stratum in which he found the specimen in question was White Lias, because the *Ostrea interstriata*, a characteristic shell of MOORE's own *Rhætic* formation, was found abundantly with it. Mr. MOORE, who had long known the beds in question, entirely dissented from Mr. TOMES's views. By a letter dated June 30, 1863, I learn from Mr. MOORE that he met Mr. TOMES, accompanied by some friends, at Bridgend, and the meeting has resulted in the following compromise as imparted to me by Mr. MOORE. He says, "I am happy to say that we came to an unanimous conclusion on the points, viz. :—There are no beds at Bridgend lower than the *Lima* series, and that the *G. incurva* therefore, which has been figured from thence, belongs to this zone, Further, TOMES was correct in saying that the *Ostrea interstriata* was associated with *G. incurva*, the former being a typical shell of the *Rhætic* or White Lias beds, but we made out the interesting fact that the shell is a *derived* one, and has been washed out of lower beds, and re-deposited with the fauna of the *Lima* series. In general we found that the little oyster was attached to Carboniferous Limestone pebbles,

" which after being rolled about in the *Rhatic* sea, had been re-deposited as " before mentioned. I told TOMES he would see some strange liassic beds " in this district, and he has not been disappointed." As regards myself, a reference to my paper will show that I had not carried the Zone of *G. incurva* as a shell of the British Lias, in its typical form, so far as the information of Mr. TOMES subsequently induced me. There is an aspect about the shell figured, which, with others in my possession, separates it by certain characters, as well of the shell itself, as of its matrix, from the ordinary form of the species to which I have assigned it; which suggests the question, " Was the oyster, (a constantly *attached* shell,) the only *derived* species found in the beds in question?"

Under any circumstances, my position is in no way affected, except that I may be called upon to reduce the amplitude of my outline or the breadth of my shade.

I remain

Yours truly,

JNO. JONES.

TO THE HON. SECRETARY OF THE COTTESWOLD NATURALISTS' CLUB.

My dear Sir,

I have written and forwarded the following to you in the hope, and I think I may say in the belief, that it may be found worthy of a place in the proceedings of your Club. I am anxious for its insertion, because it will explain some apparent inaccuracies in a communication which I made to your talented member, Mr. JONES, which was quoted by him in his paper on the Gryphites. I refer more especially to a statement which I made to him respecting the appearance of the Gryphite near the bottom of the lower lias at Bridgend. This statement attracted the attention of our mutual friend, Mr. MOORE, who entertained opinions differing materially from mine. A correspondence ensued between Mr. MOORE, Mr. JONES, and myself, which ended in a re-investigation of the subject, the results of which I propose to lay before you. But I may as well proceed in chronological order.

My first acquaintance with the South Wales lias dates from 1860, when I visited Bridgend for the purpose of examining the section there, having been stimulated to do so by my friend, Mr. ETHERIDGE. He had told me that a very remarkable section was exposed in the Railway cutting near that town, and I visited the spot in consequence of his information, and in the company of my usual field companion, Mr. KIRSHAW. We spent many hours there, seeking diligently for evidences of the several stages of extinct life, with which we were well acquainted

in many localities in the Midland Counties of England. At the close of the day only so much of the section had been understood as to increase our desire for further investigation, but as time was pressing we had to content ourselves with what little information we could reap together during this our first visit. A roughly drawn section, shewing two well marked, but distant zones, was all that could be committed to paper. Near the top of the series we found many good and well preserved specimens of *Ammonites semicostatus*, and from near the bottom I was fortunate enough to obtain the fragment of a large lima, on which were growing two species of oyster, both characteristic of the white lias of Warwickshire and the West of England. One of these is the well known Rhætic oyster, *Ostrea interstriata*, and the other an undescribed species always occurring, though more rarely, in the same beds. Now there is nothing wonderful in all this, for both the zones characterized by these fossils appeared in their proper places in the series; but it was thought remarkable that Gryphites should occur in plenty so low down as to be found associated with Rhætic fossils, there being abundance of these shells in the cutting; indeed I may say that where this one solitary little oyster was found, a hundred Gryphites might easily have been obtained. For this apparent anomaly we had been prepared by Mr. ETHERIDGE, who had said that Gryphites would be found from the top to the bottom of the section. Such was the state of things when I forwarded to Mr. JONES, the Gryphite which he figured, and it was the statement accompanying these figures which attracted the notice of our friend, Mr. MOORE, who was well acquainted with the Bridgend section. In the correspondence which followed, Mr. MOORE maintained that no other strata than those called the lima beds, and characterized by the presence of *Ammonites Bucklandi*, occurred at Bridgend, and was somewhat doubtful as to the occurrence of the true *Ostrea interstriata*, fully admitting, however, that should its presence there be proved, it would be strong evidence against his own statement. In this state of things it was suggested that the most satisfactory plan would be to institute a fresh investigation, and accordingly we agreed that we would together examine anew the section in question. This was done during the summer of 1863, the party consisting of Mr. MOORE, Mr. KIRSHAW, Mr. GIBBS, and myself. We were long in finding a specimen of the little Rhætic oyster, but at length I found one growing on a half-rounded lump of mountain limestone, near the bottom of the section, the limestone being firmly embedded in the lias. This discovery did not tend to lessen our difficulties, nor did another speedily made by Mr. MOORE, of a large example of *Ammonites Bucklandi*, near the same geological level, render the

section more intelligible. Subsequently we examined the bed containing the *Ammonites semicostatus*, which, as before stated, is seen near the top of the series. On the following day we were taken by Mr. MOORE to a coast section, where the lias was seen resting immediately upon the mountain limestone. Here I found the *Ostrea interstriata* in great profusion. It was growing on the floor of mountain limestone from which the waves had removed the superincumbent lias, leaving it just as when it flourished in the ancient sea of the Rhætic age. This specimen, as I have just intimated, was found, not so much in the lias, as on what was the bottom of the sea before the deposition of the lias; but in the immediately overlying lias appeared, as Mr. MOORE pointed out, many Lima bed fossils. Amongst these, one of the most characteristic was a species of Pentacrinite, *P. vulgaris*, Schl. ? Here then, as at Bridgend, the fossils of the Lima beds were found in close proximity to the Rhætic species, if not actually associated with them. On the following day we again repaired to the Bridgend cutting, Mr. MOORE having left us, and on this occasion both Mr. KIRSHAW and myself found specimens of *Ammonites angulatus*, near the bottom of the series. Also Mr. KIRSHAW picked up a Gryphite on which were growing no less than six small specimens of *Ostrea interstriata*. This specimen disposes of the whole question. At this locality, at any rate, the two species are coëval. Both Mr. MOORE and myself were right and both were wrong. The Gryphite figured by Mr. JONES is of the age of the lima-beds, but it is also of the age of the *Ostrea interstriata*. What I have stated above will completely exonerate Mr. JONES from the charge of inaccuracy in placing the Gryphite at the bottom of the South Wales lias. But the present communication may seem incomplete if some explanation is not given why two species should be found together, which should properly be considerably separated in time in the Liassic deposits. It cannot be that the Rhætic beds and those at the bottom of the lower lias have been deposited, and then broken up and mixed with the Lima beds at the period of the deposition of the latter, because in that case we should have a simple mixture of the species, and not one growing upon the other. I humbly submit that there is but one solution, i.e., that during the period of the deposition of the Rhætic beds no such deposition took place at the locality in question, and the little oyster continued to live until the Gryphite made its appearance on the stage of life, and that both continued to live together for some time, the oyster being the first to give way. I must apologize for the length of this letter, and with your permission subscribe myself,

Yours very sincerely,

ROBERT F. TOMES.

Address to the Cotteswold Naturalists' Field Club. Delivered at Cheltenham, Wednesday, March 9, 1864. By the President, W. V. GUISE, F.L.S., F.G.S.

GENTLEMEN,—

Again it becomes my duty as your President to lay before you a statement of the work done during the past season; and again it is a great satisfaction to me to have it in my power to assure you of our continued prosperity and well-doing.

On reference to the financial condition of the Club, I find that there is a balance in hand of £28 4s. 7d., which with the arrears of subscription, amounting to £16, will cover the extent of our liabilities. Our expenses have been heavy, and there was at one time reason to fear that we might be constrained to anticipate our income. Happily, however, the resolution agreed to at our annual meeting last year, of charging an entrance-fee of £1 to new members, has produced a sum of £12, while £4 have been realised by the sale of transactions. The opening of the tumulus at Bown Hill cost the Club £11 14s. 6d., which, though somewhat reduced by special contributions, leaves still a balance of £7 to be paid out of the funds of the Club.

It will be in the recollection of members that at our general meeting last year it was determined to limit the number of the Club to 100. We have now upon our list 95 members, and there are many applicants for admission. It has been always customary to retain upon our list the names of certain gentlemen of scientific eminence, under the designation of "consulting members," to whom the Club has been frequently indebted for much valuable assistance. These gentlemen, about seven in number, have never been called upon for subscriptions, nor is it proper that they should be; but I would ask that the 100 subscribing members should be reckoned exclusive of these "consulting members;" so that when our numbers are complete we may calculate upon an annual income derived from subscriptions of at least £50 per annum. To this we may fairly hope, by the sale of our transactions, to add annually a small sum which promises to form an increasing source of supply. When our numbers shall have reached their appointed limit, we cannot of course look for much assistance from entrance-fees, though this year that source of

revenue has proved of great value; and should you approve my suggestion of reckoning our complement of subscribing members exclusive of those whom I have termed "consulting members," we may again look this year to receive from that source an important addition to our revenue.

It is with pride and satisfaction that we can again point to the published fasciculus of our transactions, which is this day placed in the hands of members, and which fully maintains the character of the Club for good and valuable work. Dr. WRIGHT's first instalment of the Jurassic Ammonites—a subject which he is so eminently qualified to treat—is a worthy sequel to Mr. JONES's treatise on *Gryphæa incurva* and its varieties, which formed so important a feature in our published work last year. The manner, too, in which Mr. SALTER has executed his share of the work, in drawing upon stone the illustrations to Dr. WRIGHT's paper, must, I think, command our unqualified approbation. Such work as this is, indeed, an honour to any scientific body, and that it should emanate from the Cotteswold Club is a circumstance to make us proud of our Association, while it should prompt us to exert our individual energies, not only to maintain our present position, but, if possible, to extend our field of research and usefulness, by directing our attention into other parts of the wide domain of nature, of which so much still remains uninvestigated around us, and which it is one of our chief duties, as local naturalists, to explore and illustrate.

As an example of what may be done within a limited area by gentlemen working together in concert, let me draw your attention to that which has been effected in the town of Cheltenham by a small body of active naturalists, amongst whom are many members of the Cotteswold Club, who, taking for their field of operations an area comprised within a circle having a radius of seven miles from Cheltenham, have set themselves to work out a complete fauna and flora of the district; and with such success have they laboured that, although the society was formed only in 1861, they have already recorded 649 species of Flowering Plants and Ferns, (112 of which are new to the district,) Mosses 146 species, Mammals 24, Birds 159, Reptiles 8, Coleoptera 567, Hymenoptera 172, Mollusca 71, Diatomaceæ 87. Surely this is a worthy example of what may be done by patient industry directed to a specific end, and should be a spur and incentive to us to endeavour to do that for the entire county which these gentlemen are accomplishing, so usefully and so well, for the limited district of Cheltenham.

I have upon former occasions taken advantage of my office as your president to urge upon you the duty of applying yourselves—each

according to the predilections of his mind or his opportunities for observation—to the collecting and registering of facts in all branches of Natural Science; so that Geology should not wholly engross our attention, but that the other wide domains of nature in plant and animal life should receive at our hands equal and fitting illustration. We have now secured at Gloucester, by the purchase of the fine collections of our friend and colleague Mr. JOHN JONES, the foundation for a County Museum, which should present a complete illustration of the organic and inorganic kingdoms of nature as developed in our county. Our colleague, Mr. JONES, in that cosmopolitan spirit which distinguishes his enquiring mind, has set us a good example, and in his papers on the Mollusca and Reptilia of the county has commenced that work, the further prosecution of which I would strongly urge upon your attention. I may add that, in order to facilitate the collection and registration of such facts, I shall at all times be glad to receive from gentlemen or ladies, lists of the plants and animals found in their neighbourhood, of which I would keep a register, to be from time to time submitted to the Club, and published when sufficient material shall have been brought together.

With these prefatory remarks I will proceed to describe the operations of the Club during the past season.

The annual meeting took place at Cheltenham, on Wednesday, 4th March, 1863, at which a large number of members were present. The president read his address to the Club, and the secretary delivered a report of its financial condition, which was adopted and ordered to be printed. The election of officers for the ensuing year then took place, when you were again pleased to testify your confidence in myself and Mr. LUCY, by re-electing us to the posts of president and secretary respectively. It was resolved, that in future all newly-elected members should pay an entrance-fee of £1. It was further agreed to limit the number of members to 100.

The presidents and secretaries of the Dudley and Severn Valley Field Clubs were declared honorary members of the Cotteswold Field Club.

A resolution was at the same time passed, that the number of Field Clubs to whose officers the privilege of honorary membership should be extended, be limited to six.

Professor BUCKMAN read a report upon the "Tumulus" opened by the Club at Nymphsfield, in August, 1862, with notes upon the "Crania," by Dr. THURNAM. The Professor exhibited at the same time two highly polished and well-wrought flint celts, about 10 inches each in length, from a ploughed field at Crudwell, in Wiltshire.

Some well-executed flint arrow-heads from Ireland were shown by Mr. E. HARFORD; and a roughly-hewn stone hatchet, from the neighbourhood of May Hill, was laid on the table.

Professor BUCKMAN called the attention of members present to a collection of small tubers of *Oxalis edulis*, from Algiers, where they are said to grow as large as potatoes, and to be used as an esculent root. These were liberally distributed among such of the members present as expressed a desire to try the experiment of growing them in their own gardens.

Time not permitting the usual excursion into the country, the Club visited the Museum of the Rev. T. W. NORWOOD, where their attention was particularly attracted by certain Saurian remains, derived from the Great Oolite of Stowell Park, near Northleach. These were referred by Dr. WRIGHT to a species of *Teleosaurus*, new to this country, though believed to have been found in France in strata of the same geological age. The Saurian in question is said to have been described by CUVIER; there was, however, some difficulty in determining the absolute identity of the reptile, in consequence of the absence of many important portions of the skeleton, including the bones of the head. Dr. WRIGHT promised to make a careful examination of the example, with a view to a complete report at a future meeting.

About 60 gentlemen sat down to dinner at the Queen's Hotel. After dinner three papers were read:—

- 1 By THOMAS WRIGHT, M.D., on the "Palæontology of the Dumbleton Beds."
- 2 By the Rev. T. W. NORWOOD, on a "Tumulus lately opened at Foxcote, near Withington."
- 3 By Mr. JOHN JONES, on the "Natural History of the Sharpness District on the River Severn."

The account of the Foxcote Tumulus, as given by Mr. NORWOOD, is interesting and worthy of notation. The following are the facts as supplied by Mr. NORWOOD:—

A party of antiquaries, General YOUNGHUSBAND, Captain BELL, Mr. E. HARFORD, Dr. BIRD, and the Rev. T. W. NORWOOD, visited the locality referred to on the 25th February, 1863, where they found the remains of what had been a large Tumulus, about 20 yards in diameter. There were no indications of those large stones which mark so characteristically so many Cotteswold barrows. A heap of greasy black earth occupied the centre of the area. A human skeleton was found, that of a young person, said to have been of the female sex. It is important to

notice that there was *but one body here buried*, for in our usual chambered Tumuli of unknown age we generally find *several bodies*. The body is said to have been found lying at length, not doubled up. There were marks of fire on a few bones and stones; and some bits of pottery lying about within the area of the Tumulus were identical in kind with the Roman black pottery of the whole district. In the black earth were found 11 or 12 pieces of flint, of the sort known as "flint flakes." These have been found in graves of Roman age, according to Mr. THOMAS WRIGHT, as well as in "primæval" and Saxon graves, and must often have been brought over long distances.

A piece of rusty iron was found, apparently belonging to the interment. Many Roman coins were found in the Tumulus—according to the workmen, not fewer than 200. Six were picked up by Mr. NORWOOD's party, bearing the names of Valens, Gratianus, Gallienus, and Constantine 2nd. The others said to have been found there were mostly small brasses of Valens, Valentinian, Tetricus, Gratianus, Victorinus, Gordian, Maximian, Postumus, Tacitus, Claudius Gothicus, Constantine 2nd, Constans, and Constantius, with several of the "Urbs Roma" and "Constantinopolis" type. With these were five or six coins, very small and rude, not Roman, but probably struck in imitation of Roman coins. The coins were not contained in any vessel, but were scattered broadcast throughout the mound. Mr. NORWOOD has come to the conclusion, from the foregoing facts, that this grave was Roman or Romano-British, of the date of about 400 A.D.; and he gives it as his opinion that in no other instance, in so far as he is aware, has it been found possible to fix an approximate date to an ancient Tumulus with so much probability as in the instance thus brought under our notice.

Mr. NORCUTT read a brief outline of the proceedings of the Cheltenham Naturalists' Association, to whose excellent work I have already made reference; with which the proceedings of the day terminated.

Wednesday, 20th May, 1863. The Club met at Stroud. The principal work of the day was the opening of a "Barrow" on Bown Hill, near Woodchester, which had formed a subject of discussion towards the end of the previous season, when, the period of the year being too far advanced, the work of exploration was deferred. Workmen had been employed under Dr. PAYNE and Mr. WITCHELL on the two previous days; but beyond the discovery of the entrance to the sepulchral chambers, no great progress had been made in the excavation of the mound, which, from its size and solidity, proved to be a very laborious operation. In order, therefore, to expedite matters, a strong force of labourers, 22 in number,

had been employed from an early hour on the day of meeting. The mound, which measured about 60 yards in length by 17 in extreme width, was seen to be constructed of angular masses of stone, heaped together without any order or regularity, amongst which were scattered blocks of considerable size and weight.

The excavators had opened a trench about 100 feet in length, in a direction due East and West by compass. The western extremity was the broadest, the mound gradually diminishing in width to the opposite end. The workmen had struck upon the entrance, which, when exposed, shewed a chamber formed of five large unhewn stones, two on each side and one placed transversely, the dimensions of which were 4 feet in width by 8 feet 6 inches in length. There was no covering-stone, but the entrance was flanked on either side by a wall of dry masonry, very neatly fitted, forming a segment of a circle, which, if completed, would have enclosed a well-like chamber in front of the entrance to the Tumulus. This wall had been abruptly broken off; but there were amongst those present some who thought they detected signs of its having been at one time continuous. It was evident that the whole structure had been thoroughly ransacked and broken up by former explorers; and so completely had the work of devastation been accomplished, that hardly one stone was left upon another. The chambers, with the one exception already noted, had been entirely demolished, and but a few bones scattered throughout the Tumulus remained, all more or less in a fragmentary condition. These fragments comprised one fully developed frontal bone, male; portions of two male lower jaws, and portions of two female skulls; several thigh-bones, and bones of the leg and foot, including the remains of children, but all much broken. There were found the remains of six individuals at the least, viz., two men, two women, and two children, the latter between six and eight years of age. There were several bones of cattle and calves; teeth of horse and ox; a portion of the bones of the foreleg of a dog; several boar's teeth, tusks, and grinders, and parts of jaw-bones; a bone "scoop," formed of a shank bone of a horse; and a large quantity of a black unctuous substance, having the appearance of wood or animal charcoal; but no burnt bones. A small portion of a flint-flake was detected in the black paste. Besides the organic remains above enumerated, some pieces of rude pottery were found, which, with a Roman brass coin of the Emperor Germanicus, completes the list of objects yielded by the exploration of this large sepulchral mound, which, in consequence of the violence it had undergone at the hands of former explorers, afforded but little to compensate the Club for the trouble and expense of opening it.

From Bown Hill the party proceeded to the residence of Mr. MARLING, and partook of a luncheon most hospitably provided for them.

The president and secretary accompanied Mr. WITCHELL to inspect the excavations for a reservoir on the hill above Stroud, which have yielded the materials from which our colleague Mr. JOHN JONES has constructed the very interesting paper since communicated to the Club.

Wednesday, 17th June, 1863. In pursuance of the plan for the first time acted upon in the previous year, of holding annually one of our meetings outside the boundary of our own county, the Club met at Dudley, in Warwickshire, a district remarkable for its natural beauty, and geologically celebrated for the perfection of the fossil organisms, yielded by the Silurian beds in its immediate neighbourhood.

The members of the Severn Valley Field Club and of the Dudley Geological Society mustered in considerable numbers, and acted throughout the day as our guides to the points of greatest interest. The ground traversed included the Aymestry Limestone beds at Sedgley, and those on Beacon Hill, the quarries at which latter locality yielded an abundant supply of characteristic fossils, including *Encrinurus variolaris*, a Trilobite of some rarity. The Wenlock Limestone of Hurst and the Wren's Nest were next examined, and the profusion of animal life in that remote epoch, together with the exquisite state of preservation of the organic remains, was well shown in some slabs of Wenlock Limestone exposed on the side of the road leading to Tipton, across the end of the Wren's Nest Hill. This latter dome of Silurian rock, one of the most remarkable features of the neighbourhood, has been so admirably illustrated by Sir RODERICK MURCHISON in his "Siluria," that it is only necessary to refer to that work in order to learn all that can be sought for of its geological structure. But those who would desire to apprehend its natural beauty, and would enjoy the chequered effects of light and shade underneath the huge buttresses of rock, left for the support of the mountain-side after the extraction of its extensively-quarried limestones, should visit the Wren's Nest Hill on such a glorious day of summer as that which smiled on the Cotteswold Club.

The Castle Hill and ruins occupied the attention of the party during the remainder of their ramble, and dinner at the Dudley Arms gave fitting termination to a day most agreeably spent.

After dinner Mr. JOHN JONES read a very interesting paper on the discovery by Mr. WITCHELL of flint implements of human manufacture, associated with land and freshwater shells, in a sedimentary deposit upon a hill above Stroud, which paper has since been published. Mr. JONES

argued that the relation of the deposit in question to the underlying beds, and the fact that the entire series of beds on which the deposit rests, appear to have partaken of an alteration of dip subsequent to the deposition of the more recent formation, justify him in considering it as not improbable that "previous to the scooping-out of the picturesque combs of the Stroud Valley, the now distant hill-tops may have formed portions of a widely-continuous level tract, presenting alternations of morass and thicket, on the surface of which the deposit under consideration may have formed the bottom of a pond of considerable capacity."

The question thus opened up by Mr. JONES requires still further elucidation, which it will doubtless receive at the hands of the Cotteswold Club. In the meantime I may be permitted to observe that the circumstances, as at present detailed, scarcely seem to warrant the vast antiquity ascribed by Mr. JONES to the freshwater deposit in question.

Wednesday, 15th July. The Club went by steamer down the Gloucester and Berkeley Canal to Fretherne and Sharpness, landing by the way at the former locality, where the fine escarpment of part of the *Bucklandi* zone of the Lower Lias presents one of the finest sections to be seen in Gloucestershire. Here the well-timed hospitality of Sir LIONEL DARRELL drew the party aside to partake of luncheon at his residence, an act of courtesy which was highly appreciated, as the day was one of exceeding heat.

Attention was directed *en passant* to the Parish Church of Fretherne, which has lately been restored by Sir LIONEL DARRELL in a manner that does credit to his taste and liberality, and which drew forth expressions of warm approval from all the visitors.

The Club dined at Sharpness, where the tables were laid *al fresco* under the shade of the trees on that beautiful promontory, commanding an extensive prospect over the Severn to the Forest hills beyond, which is justly considered one of the most beautiful landscapes in a district abounding in fine natural scenery.

After dinner a communication was made by Mr. JOHN JONES of a discussion which, since the publication of his monograph on "*Gryphæa incurva* and its Varieties," has arisen between him and Mr. C. MOORE, of Bath, respecting the alleged discovery of *Gryphæa incurva* associated with *Ostrea interstriata* in Rhætic or Upper Keuper beds near Bridgend, in Glamorganshire. The information upon which Mr. JONES based his statement of the presence of the Gryphite in the White Lias, was furnished to him by Mr. TOMES, a gentleman whose labours as a geologist are well known and appreciated, and whose character as an accurate observer

justifies the fullest confidence in the accuracy of any facts stated upon his authority. Mr. MOORE, on the other hand, denied the presence of the Rhætic beds in the section referred to, but admitted that the occurrence of the Rhætic Oyster (*Ostrea interstriata*) would afford strong *prima facie* evidence of the fact, should its presence there be proved. In order to test the matter, Messrs. MOORE and TOMES met at the Bridgend section, and there found *O. interstriata* in company with *G. incurva*, as Mr. TOMES had stated, but under circumstances which led to the conclusion that the *Ostrea* was out of its true horizon—an emigrant, not a native—derived from the underlying beds, where it was found “growing in profusion on a floor of Mountain Limestone, from which the waves had removed the superincumbent Lias.” But this is not all: “A Gryphite was picked up, on which were growing no fewer than six small specimens of *O. interstriata*,” which, in the words of Mr. TOMES, “disposes of the whole question.”—“at this locality, at any rate, the species are coeval.” A most remarkable and instructive discovery is this; one which shews with how jealous an eye we should scrutinize the most minute facts in connexion with geologic enquiry; while at the same time it should prompt us to exercise the utmost caution in laying down dogmatic formulas for the government of such a science, seeing that the occurrence of an Oyster out of its place may suffice to raise doubts respecting the presence of an entire epoch of creation.

It is clear that from henceforth *Ostrea interstriata* can no longer be looked upon as typical of the White Lias; but like so many border forms, which are common to two adjoining but wholly distinct formations, is characteristic of neither. Its place is truly and naturally in the White Lias; but we have here incontrovertible evidence of its having crossed the boundary of the Rhætic beds into those of the Lower Lias, where, however, it would seem to have encountered circumstances no longer favourable to its growth and extension, and, after a short struggle, to have become extinct.

On the return voyage by the canal, Mr. JONES read a paper on the Reptilia of the county, and exhibited a fine pair of horns from the bed of the Severn, which Professor OWEN has decided to belong to *Bos primigenius*. There is reason to believe that the horns in question have been derived from extensive peat deposits, which have been traced for great distances along both banks of the Severn, containing trees and well-preserved leaves, fruits, and roots, in all respects similar to those which characterise the submerged forests found in so many localities around our coasts. Antlers of large size have been procured from thence.

The horns of *Bos primigenius* were found at no great distance from the mouth of the "Royal Drough," the great drain of the district, along the sides of which the deposit of peat has been traced for a distance of nearly two miles.

Wednesday, 19th August. The Club met at Cheltenham with the intention of visiting the Marlstone Quarries at Gretton, but the weather proving unfavourable, it was decided to limit the day's excursion to a visit to Cleeve Hill, with a view to a re-examination, in company with Dr. HARVEY HOLL, of the beds at the Rolling-bank Quarry, respecting the correlation of which, Dr. HOLL has put forth opinions not in accordance with those held by Dr. WRIGHT, and published by him in detail in the transactions of the Club for the year 1860. Dr. WRIGHT there gives it as his opinion that the beds in question represent the Middle Division or *Humphresianus zone* of the Northern Cotswolds, capped by the Lower Trigonía Grit, and resting upon the Oolite Marl.

In the proceedings of the Geological Society for the year 1863 will be found a paper by Dr. HARVEY HOLL on the "Correlation of the several subdivisions of the Inferior Oolite in the Middle and South of England," in which the author takes a view of the position of the beds referred to, different from that advocated by Dr. WRIGHT, and assigns to them a position higher in the series.

Dr. HOLL's views, as furnished to me by him, are as follows:—

"We first examined a section of the Peagrit, which I should think was fully 40 or 45 feet in thickness, the lower 25 of which was a rather coarse-grained Freestone, while the upper 20 was a yellowish-coloured Marly Oolite, pisolitic only in certain layers; and surmounting this was the lower part of the Lower Freestone. Ascending the hill we next visited a quarry in the Lower Freestone, capped by the Oolite Marl.

"We then crossed over the out-crop of the Upper Freestone, and examined its junction with the Lower Trigonía Grit, as seen in a number of small pits on the Northern side of the ravine, which runs eastward to Postlip. Below the Lower Trigonía Grit was a bed of brown and blue Clay, probably the equivalent of Dr. WRIGHT's Chemnitzia Clay. This was underlaid by hard brown coarse-grained Limestone containing fragments of shells, and below this was a bed, about three feet in thickness, of yellow and brownish Sand, with lenticular masses of Sandstone, which passed downwards into a more or less ferruginous sandy Oolite. These beds below the Clay constitute the upper part of the Upper Freestone."

These pits, and the three places next visited are alluded to in Dr. HOLL's paper before mentioned.

"We next proceeded northwards to the quarry No. 2, shewn in the section on the other side, which is situated on a rather lower level, and exhibits the Lower Freestone and Oolite Marl, capped by a few feet of the Upper Freestone. These beds dip easterly at a low angle (about six degrees;) and a little further to the east we came to another quarry, (No. 3,) shewing nearly the whole of the Upper Freestone, sandy, and unfossiliferous; and still further on in the same direction we found a third quarry, (No. 4) exposing the same beds, also nearly, if not quite, unfossiliferous.

"From the last quarry we proceeded to view the 'Rolling Bank quarry.' The arrangement of the beds, (of which the following sketch will perhaps give some idea,) was well exposed at the time of our visit.

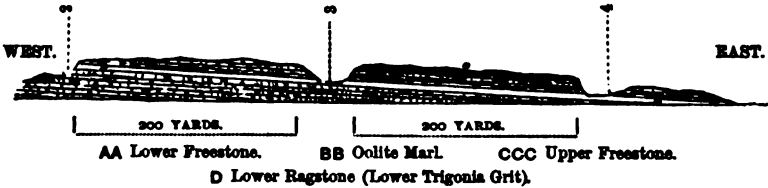


"Dr. WRIGHT contended that the beds into which the Rolling Bank Quarry has been excavated, are the same as those in Nos. 3 and 4, but which had become locally fossiliferous. But there is one circumstance which, it appears to me, is quite fatal to his argument; which is, that inasmuch as the beds of the Rolling Bank Quarry are more or less fossiliferous throughout, it is improbable that the fauna so abundant at this spot should have remained local throughout the whole of the period during which strata to the thickness of 22 feet were accumulating, and not have spread, during the latter portion of that period, at any rate to the neighbouring quarry, distant only about 400 yards, knowing as we do that there is a tendency for the fauna of any particular spot to radiate, and spread over wider and wider areas as time advances.

"Assuming therefore that the life of the lowest beds was confined to the Rolling Bank Quarry, we cannot, I think, admit the probability of its continuing to have been so restricted during the deposition of every succeeding bed, each of which was slowly accumulated, as we infer, not only from the nature of the material of which they are composed, but also from the fact that certain species came into being, flourished, and became extinct, almost within the limits of a single stratum, as for instance was

the case with *Terebratula Phillipsii* and its variety *Ter. Buckmanni*.

"I think that DR. WRIGHT is quite correct in saying that the beds of the Rolling Bank Quarry are the equivalents of the Dundry beds, but he has fallen into an error in referring them to the Upper Freestone. In tracing the Dundry beds northwards, it appears to me he has overlooked the intercalation of the Upper Freestone at Avening, and in so doing has passed from a higher to a lower level, without being aware of it. Both the Dundry beds and the beds of the Rolling Bank Quarry belong to the Trigonia Grits, but in the latter locality they are displaced downwards, and rest upon the Upper Lias Clays."



DR. WRIGHT's reply to the foregoing observations of DR. HOLL, is as follows :—

"It seems to me that it is a case of 'Much ado about Nothing,' for had my account of the Rolling Bank Quarry been correctly quoted, there would have been little or no occasion to find fault with it. After defining what I mean by the zone of *Am. Humphresianus*, I stated that this zone is represented in the North Cotteswolds by a series of ferruginous Oolitic Limestones raised for road material at Cleeve Hill. Then follows an account of the different beds and the lists of the fossils contained in each. I prove that these beds are covered by the Lower Trigonia Grit, and rest upon a bed of Marl, which forms the floor of the quarry. I was the first to describe these beds, determine the fauna, and point out their correlation with the zone of *A. Humphresianus* in other regions, and I am not aware that I ever called them Upper Freestones, my object being to show that we possessed the Middle Division of the Inferior Oolite in the Northern Cotteswold. In speaking of the flaggy beds above the Oolite Marl in the Leckhampton Hill section, I may have said that they occupied the stratigraphical position of the zone of *A. Humphresianus*; but that is very different from the version that 'the beds of the Rolling Bank Quarry are the equivalent of the Bastard Freestones.' This could only be proved by a comparison of the fauna in each set of beds; and as the Rolling Bank beds are fossiliferous, and the others only sparingly so, I went no farther than to state that they occupied the stratigraphical position of the *A. Humphresianus* beds, between the Oolite Marl and the Lower Trigonia Grit. One set of beds may occupy

the stratigraphical position of others which may be *identical* or *different* from local causes,—fossils being the only true test of identity.

“I have given my reasons for the division of the Inferior Oolite into three zones, and have accurately defined the limits of each of these zones ; and working out the Geology of our district on that basis, I deny that the *A. Humphresianus* zone belongs to the zone of *A. Parkinsoni*, which, according to my definition, includes all the beds from the Lower Trigonias Grit up to the Fullers-earth.”

On Monday, 7th September, the Club met at Malvern, where a general gathering of Field Clubs took place under the direction of our colleague, the Rev. W. S. SYMONDS, president of the Malvern Field Club, who, in spite of the wind that blew, assembled around him on the summit of the Worcestershire Beacon a large audience of ladies, as well as gentlemen, to whom he discoursed most eloquently and instructively on the geological features of the vast panorama of hill and valley which lay stretched like a map at their feet. At the conclusion of Mr. SYMONDS's address, the party proceeded to examine certain beds at the base of the hill, which Dr. HOLL, bringing to bear his experience in transatlantic geology, has identified with the so-called Laurentian Gneiss of North America. A lively discussion upon this point took place between Dr. HOLL and Mr. WYLLIE, of the Irish Survey, the latter strongly combating the views of Dr. HOLL ; which discussion was renewed at the trap bosses in Cowleigh Park, in which Dr. HOLL again recognised altered sedimentary deposits, while Mr. WYLLIE maintained that they were true eruptive rocks. The point here raised, and which Dr. HOLL is engaged in working out, is one of great interest, as it will, if proved, shew the presence in the Malvern range of a series of sedimentary deposits which may ultimately prove to be the equivalents of the “fundamental Gneiss” of the North-west coast of Scotland, which Sir RODERICK MURCHISON correlates with the Laurentian beds of Canada, the oldest known sedimentary rock on the planet's surface. The Field Clubs dined together at the Link Hotel ; after which a large number accepted the invitation of Dr. GRINDROD to partake of tea and coffee at Townshend House, and examine the very choice collection of fossils, which the learned Doctor has, at considerable expense, accumulated in his Museum. This was the last meeting of the Field Club for the season.

It now only remains for me to return my sincere thanks for the support which has been so constantly accorded to me, and to express my earnest hope that all may for the future continue to work cordially and energetically together, and thus to extend the influence and promote the prosperity of the CORRESWOLD CLUB.

*On a Deposit at Stroud Hill, containing Flint Implements, Land and Freshwater Shells, &c. By EDWIN WITCHELL, F.G.S.**

READ AT CHELTENHAM, MARCH 9TH, 1864.

IN the course of some excavations in the construction of a reservoir, near the summit of Stroud Hill, made during the past summer, I observed in the clay, at a depth of about two feet from the surface, a deposit, which on examination I found was full of land shells, with a few freshwater bivalves. A list of these shells has been made by Mr. JOHN JONES, one of our colleagues, who with myself collected most of them in the course of a short visit at the works, and, with the exception of two which have been lately found by me, they are contained in his interesting paper upon the subject of this deposit published in the Transactions of last year. The two additional shells are *Helix lamellata*, and *H. lapicida*; the former, as I am informed by Mr. JONES, not being now an inhabitant of this part of England.

The deposit was a kind of tufa; it contained near its base numerous flat stones, fragments of the stony bands formed of the valves of *Ostrea acuminata*, a shell which characterizes the upper portion of the Fullers-earth. Some of them were of considerable size, and the surfaces of the whole showed signs of erosive action. It was traced up the slope of the hill to the extent of 126 feet, and along the hill-side about 60 feet; in the latter direction its extent was not disclosed by the works, but traces of it were found in a pit at a distance of 120 yards.

As the excavation proceeded, I discovered in the deposit several flint flakes, of the usual primitive type, flint nuclei, part of an arrow-head, fragments of an antler, a tusk, (probably of a boar,) with numerous small pieces of carbon and small stones, which had been subjected to the action of fire. Flint flakes, two arrow-heads, bones, &c., have been found by other persons visiting the spot.

In the *overlying* earth, which varied from two to four feet in thickness, a few pieces of rude pottery were picked up.

* To enable those members of the Club who are not acquainted with the locality better to understand this paper, I beg to refer them to the section made by Mr. JOHN JONES, which is in the last Transactions, at page 103.

The position of the bed is a singular one, the ground falling away considerably towards the Slade Valley on the one side, and towards Horn's Valley on the other, forming an elevated spur, somewhat rounded on its summit, with a deep valley on either side. The position of the shelly bed is at the end of the spur, where it joins the general elevated land of the district. Its elevation above the sea level is about 650 feet, and that of the summit of the hill about 750 feet.

The formation on which the bed is deposited is Clay, derived from the Fullers-earth into which it passes downwards, and above, on the hill, is the western edge of the Stonesfield Slate. In the Fullers-earth, about 50 yards higher up the hill than the shelly bed, is a line of small springs, extending along the hill side to a considerable distance. These springs issue beneath a steep slope, forming the upper escarpment of the hill; and below the shelly bed some 80 yards, is a second escarpment, formed by the Ragstone beds of the Inferior Oolite.

In suggesting any explanation of the formation of this shelly bed, it may be in place to notice the various changes which the surface of the slope appears to have undergone. Thus we have first the original surface of Fullers-earth converted into workable clay, or brick-earth. Overlying this is the shelly bed, upon which is recent mould, intermixed with *debris* of the upper beds of the Fullers-earth, which have evidently slipped from their proper position, the point of contact with the shelly bed being distinctly shown throughout the excavation, the one never having become intermixed with the other.

The formation of the Clay was not the result of any great amount of disintegrating action, or it would be found to contain traces of the constituent parts of the beds forming the higher ground, which is not the case. The shelly bed is in immediate contact with the Clay, there being no trace of any intermediate deposit except the flat stones before referred to. These stones may have been carried down the slope from the higher beds by means of land-slips, and the finer or lighter particles having been washed away, the stones would be left scattered upon the surface, afterwards to become mixed with the shelly deposit as it accumulated.

To the same agency also, that of water and land-slips, the shelly bed itself may perhaps owe its origin. Indeed, it is difficult to account for its existence otherwise than upon the assumption that it took place in still water. It is in some places a mere sediment compressed by the overlying earth, and the slope on which it rests being at an incline of 13 degrees, the smallest running stream would inevitably have carried it farther down the hill, where the surface is comparatively level, and not

have deposited it where the angle of inclination is greatest, but for the interposition of some considerable barrier similar to that which a land-slip would produce.

It is necessary, however, to account for the formation of a barrier of sufficient height and bulk to form an embankment capable of retaining water covering a considerable area, and in attempting to do this, much must of necessity be left to conjecture, but the appearance of the ground suggests an explanation of the matter by no means improbable. The steep slope above the line of springs already referred to as the upper escarpment, doubtless owes its present shape to land-slips, occasioned by springs issuing from beneath, and if we suppose that at some distant period a slip of considerable magnitude took place from this slope, the material of which after passing downwards to the more level surface above the lower escarpment, and there for a time becoming stationary,—we have a dam formed, and, as the springs followed the same course, a pond would be the result; the land shells and sediment would be brought into it by means of the springs and land-floods, and the shelly bed is accounted for.

But the dam has totally disappeared, and its disappearance as well as its formation has to be explained. The same cause which led to its existence will, however, account for its destruction. The embankment,—never perhaps settled upon a very solid foundation,—might, in a period of an excessive flow of water, have again become in a state of movement, and it is not unreasonable to suppose, that it passed over the lower escarpment, which is only about 80 yards distant, and was ultimately wasted in the long slope of the hill.

The formation of a pond as the consequence of a land-slip is not inconsistent with the known results of the action of springs issuing from the beds of the Fullers-earth. Thus, at Brimscombe, three miles distant, these springs have in some former period caused an extensive slip of Fullers-earth, which is now found covering the bottom of the valley, in a stratum of considerable thickness, its original position being at an elevation of at least 400 feet above the valley; and at Chalford, in the same locality, there is at this time, and from the same cause, another mass of Fullers-earth, covering a surface of about two acres on its way downwards into the valley.

Although there are no remains of land-slips of any magnitude now to be seen on the slope of the Fullers-earth on Stroud Hill, yet it is apparent from the disturbed condition of the surface of the beds below, that extensive slips have taken place from those beds; and it is singular

that at a short distance below the pasture field in which the shelly bed was discovered, there is a valley formed by a large slip from the ragstone and upper freestone beds, running parallel with the hill to the distance of 60 or 80 yards, and about 40 yards across, which only requires one of the springs above to be turned into it, to produce all the conditions requisite for the formation of a second and similar shelly deposit. If, therefore, a valley can be thus formed in the lower part of the hill by masses of rock, it is not unreasonable to suppose that a similar valley could be formed on the slopes above by the slipping of the Fullers-earth clay.

If it be conceded that a pond or small lake once existed upon the site of the shelly bed, it follows, of course, from the contents of the deposits, that it was a place to which the inhabitants of the district resorted for various purposes, the carbon (*animal* charcoal) which is found throughout the bed, even to its lowest part, proving that during the whole period of its formation, the surrounding country was inhabited.

The changes which have taken place in the aspect of the slopes and the covering up of the deposit with vegetable mould from two to four feet thick, must have been the work of a very long period, and there can be little doubt that the people by whom the flint instruments were formed, and who left behind them the other traces of their existence, were some of the very earliest inhabitants of this country. In further proof of this opinion, is the fact that *Helix lamellata* (one of the shells mentioned in the list) is not now an inhabitant of this part of the country, not being found south of Scarborough.

Conclusions.—That a lake or pond of greater or less extent once existed upon the slope of Stroud Hill, in which the shelly bed was deposited. That it was formed by means of an extensive land-slip from the higher ground. That human dwellings were in its vicinity, and that fire was largely used near its margin. That all traces of it have disappeared, except the shelly bed, the whole being now covered up by the accumulation of mould, with additions from small land-slips.

Notes on the Ancient Crosses of Gloucestershire, continued. By CHARLES POOLEY, Esq., of Weston-Super-Mare.

PREACHING CROSS AT IRON ACTON.

IRON ACTON lies about three miles west of Sodbury, and twenty-three south of Gloucester. It is said to owe its name to a bed of iron ore, worked from time immemorial, in the neighbourhood; and to a forest of oaks which flourished on the same spot,—Æc: Sax., signifying an oak tree. Instead of this derivation, it is far more likely the manor took its title from the family of the Actons or Actunes, into whose possession it came soon after the Norman Conquest. John de Acton was seized of this manor in the beginning of the reign of Henry III., and it appears by a record of 15th Ed. I., that he and his ancestors enjoyed this, time out of mind. A lineal descendant of John de Acton, Sir John de Acton, died seized of this manor, 17th Ed. III., but, be it remarked, left no issue.

The Cross is situated in the churchyard, on the north side of the church. Lysons, who has etched it, concludes it to be of the time of Hen. VI.* Bigland, (created Garter Principal King of Arms, A.D. 1780,) connects the date of the Cross with that of the church, which he refers to the fifteenth century. He describes it thus:—"The Cross has four sides, on each side two shields, one or two of which are plain, two or three seem to have mechanical instruments, such as hatchets, &c., carved on them, but those which had arms are obliterated."† This, however, is not the case, since, with the exception of being somewhat weather-worn, and

* Etchings of Views and Antiquities in the County of Gloucester, by Samuel Lysons. 1791. A Collection of Gloucestershire Antiquities, by Samuel Lysons, F.R.S., F.S.A. 1804.

† Historical, Monumental, and Genealogical Collections, relative to the County of Gloucester. Printed from the Original Papers of the late Ralph Bigland, Esq., Garter Principal King of Arms. London. 1791.

materially differing from Garter's description of them, the devices on all the shields are exceedingly well preserved, and are as capable of being interpreted as ever they were.

The building is composed of two tiers, or stages, raised on a platform of three octagonal steps. The plan throughout is square, the four buttresses at the angles of the lower stage being connected by groining-ribs, ornamented with sculptured bosses, some of which represent oak-leaves and acorns, to the capital, still pendent from the roof, of what was once an eight-sided central shaft, a portion of whose pedestal still remains inserted in the floor. The arched spaces on three sides of this stage are divided by a transom, the upper division being completed by an elliptical arch of very graceful proportions, and the lower by pairs of five-centred arches, with bold mouldings and perfectly plain cusplings. The perpendiculars between these arches are destroyed, but the foot of each is left projecting from the sill. On the south side the whole of the arched space is open, nor is there the slightest trace of any division ever having been made. The outer ogee line of each arch is crocketed, and terminates in a finial. The spandril space thus formed between the outer and inner mouldings is filled in by a well-executed carving of oak leaves in trefoil. It is evident from the general design, the outer buttresses once terminated in pinnacles.

The second stage is formed by a square block of masonry, resting on the crown of the vault, into which is inserted a four-sided shaft, niched on its facings, and crowned by elaborately-carved three-arched canopies, with mouldings and finials; the pedestals to these niches, in the form of brackets, project from each side of the square. Two or three circular drill holes in the pillar, lead to the inference that sculptured figures were formerly placed there. This basement of the second stage is ornamented on its sides by eight shields, each shield being encompassed by a pair of long drooping wings, which originally sprung, as may be seen in the only one that is perfect, from the shoulders of a priest, attired in an alb, whose hands clasp and support the shield. This symbolic representation of the priesthood, wherein the priest is exalted to the divine character of a "ministering spirit," is so very unusual in this style of sculpture, that it may be doubted if angels are not meant instead, especially as in some old sculptures the alb is worn by them. The outline, and figure generally, and particularly the remains of a tonsure, are so well marked, however, that I think I am correct in stating it to be that of a priest. Into the top of the shaft, and finished by broaches, is inserted the base of an octagonal column, which might have been some six or eight feet higher, and this

again surmounted by a finial and iron cross, to complete the harmony of proportion of the whole. The present actual measurement of the Cross is as follows:—

Extreme width at Base.	Base line to Floor of Arch.	From Floor to Crown of Arch.	Width of Arch.	From Base of Second Tier to top of Canopy.	Size of Shields.	Square Block Base of Second Tier.	Top Pillar.	Total Height from Ground.
ft. in. 10 9	ft. in. 4 6	ft. in. 6 4	ft. in. 2 11	ft. in. 6 3	in. 11 × 8	ft. in. ft. 3 2 × 2	ft. in. in. 3 2 × 16	ft. in. 19 2

The total height of the original building to the summit of the iron Cross would thus be about 30 feet.

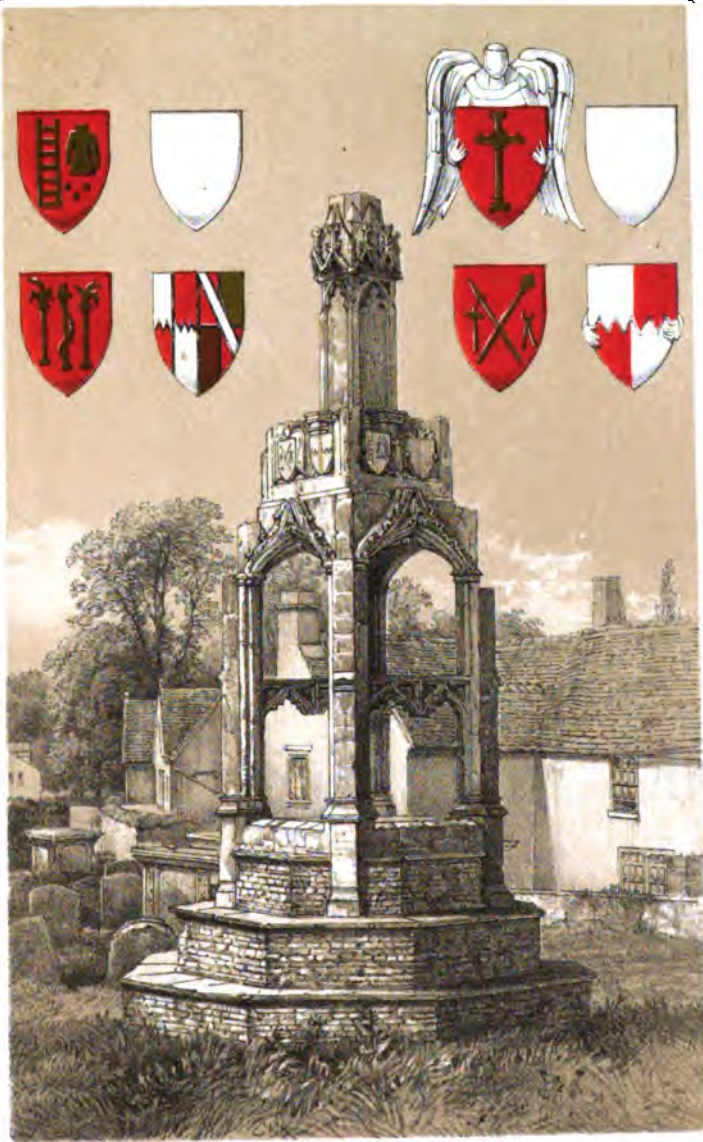
Of the shields already alluded to, one on the north side and one on the south are armorial, and have their devices *incised*. The insignia on the others do not consist of “mechanical instruments, such as hatchets,” &c., as Garter erroneously supposed, but are simply the very significant and Catholic Emblems of the Passion, beautifully carved in relief. Two of the shields are blank, never having been touched by the chisel. Although neither armorial nor truly heraldic, the four shields containing the Emblems of the Passion, admit of being described in heraldic terms. As they are not depicted in colours, taste alone can guide us in this respect. It seems proper that the field should in all these cases be *Gules*, in allusion to the outpouring of the Blood, and the Emblems *Gold*, in allusion to the Golden Fruits of the Lord’s Passion. The relative position of the shields on the Cross, and their respective emblazonments, would then be as follows:—

EAST SIDE—Two Shields. One shield blank; the other charged. On the dexter side a Ladder erect, and on the sinister, a Man’s Vest in chief, and three Dice (two and one) in base.

WEST SIDE—Two Shields. One shield blank; the other charged with: A Passion Cross, surmounted at its centre by a Crown of Thorns; above it an Escroll, and at each extremity of the transverse beam, and at the foot, a Passion Nail.

NORTH SIDE—Two Shields. One bearing a Coat of Arms; the other having:—In the centre, a Pillar* in the form of a Cross, between two Knotted Scourges with handles erect.

* The pillar against which our Saviour was scourged, and which, it is said, is still to be seen in the Church of St. Procrustus, at Rome.



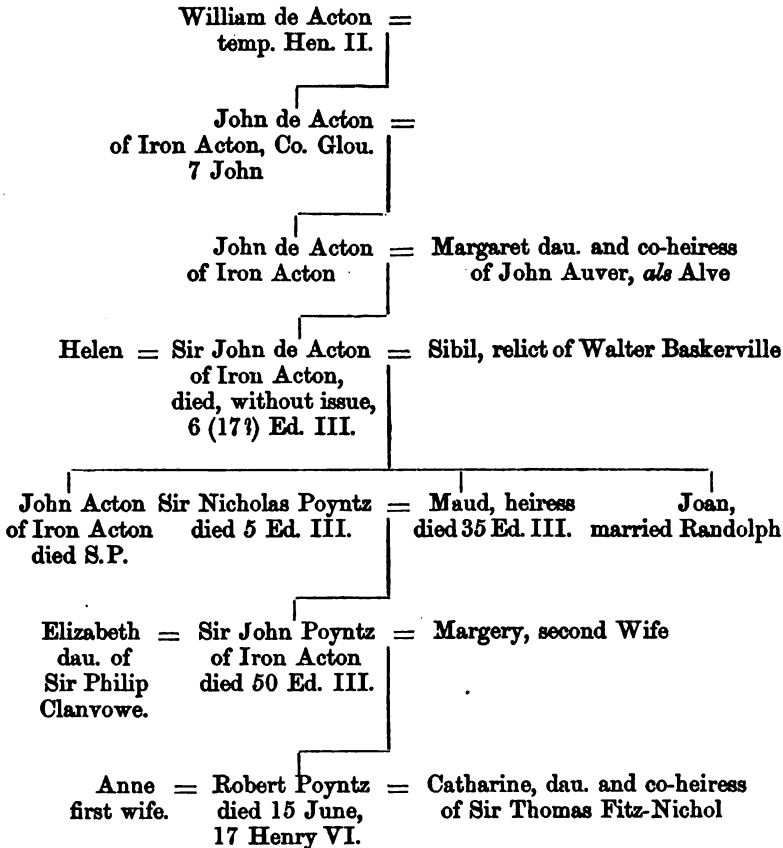
THE WELL AT ST. MARTIN'S, LONDON.

THE WELL AT ST. MARTIN'S, LONDON.

SOUTH SHIELD—Two Shields. One bearing a Coat of Arms ; the other charged with:—A Spear, and Staff tipped with a Sponge in saltire, between on the dexter side, a Hammer, and on the sinister, a Pair of Pincers.

The Emblems of the Passion thus depicted, though uncommon in this country, are frequently met with *in partibus transmarinis*. As to the two *incised* shields with armorial bearings, which Garter affirmed were obliterated, it is plain they consist respectively of a Coat of Arms, and the same coat and another empaled. It will be remembered that the first Lords of the Manor were the Actons, and at the decease of Sir John de Acton 17 Edw. III. (A.D. 1344), the line of the Actons became extinct. This date would not only be too early for the Cross, but there is no marriage in the Acton family to answer for the empaled coat.

The following manorial Pedigree of the Actons, extracted from the Register of the College of Arms, will elucidate this more clearly.



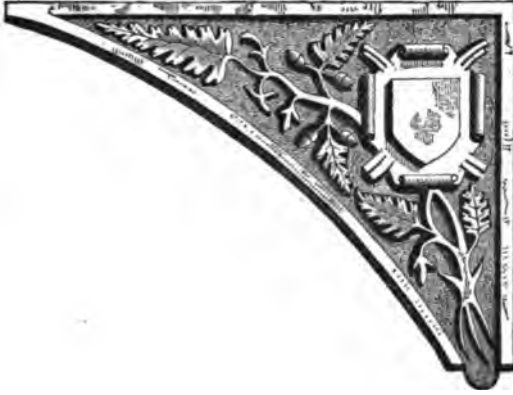
On the extinction of the direct line of the Actons, the manor afterwards descended to Sir John Poyntz, son of Nicholas Poyntz, who married Maud, next of kin and heiress of Sir John de Acton. Sir John Poyntz, who was heir of the last of the Actons, lived till the 50th Edw. III. (A.D. 1377,) and then died, leaving his son, Robert Poyntz, his heir, who lived till the 15th June, 17 Hen. VI. (1439,) having married to his second wife, Catharine, daughter and co-heiress of Sir Thomas Fitz-Nichol, by whom he had a son and heir. These are clearly the two individuals to whom the shields refer.

The arms of the Actons are, Quarterly per fesse dancetté, *Argent* and *Gules*. Those of Fitz-Nichol:—Quarterly *Gules* and *Or*, a bend *Argent*. And these arms exactly correspond to those on the shields. Thus one shield bears the arms of Acton only, or, more correctly, of Poyntz, *as the Lord of the Manor of Iron Acton*; and the other shield carries the same arms, empaling those of Fitz-Nichol. Using the arms of his grandmother Acton, through whom he inherited the manor of Iron Acton, instead of his paternal coat of Poyntz, would be a very probable thing for Robert Poyntz to do, for such a purpose, and in such a situation, even if he did not adopt the Acton arms altogether, which he very likely may have done. There can be no doubt, then, in the conclusion, that these *incised* shields are for the Lord of the Manor and his wife, as above stated, *at the period of the erection of the Cross*; which date closely corresponds to that assigned to it by Lysons, and is also verified by the style of architecture.

The name of Acton, as we have seen, was associated with the manor at a very remote date, and it is more than likely, in accordance with ancient usage, the manor took its name from the family, and not the family from the manor. As no crest is recorded for Acton of Iron Acton, the male line having become extinct so early, it probably passed into oblivion with the last male Acton. Still, considering the fact, that oak leaves are conspicuously carved in the spandril spaces of the arches of the Cross, in the bosses of the groining-ribs, (and I found them also enriching the spandrils of an old gateway leading to the quadrangle of Acton Court, where an oak branch with acorns supports a shield, (see woodcut), too defaced to admit of any device being distinguished on it,) I am inclined to the opinion that the crest of the Actons was an oak, which would exemplify the name, and be thus perpetuated in the manor.

I cannot conclude this interesting enquiry without drawing attention to the great beauty of the design of the Cross. There is no discordant

line or debasing style in it, and its proportions and ornamentation are singularly harmonious. As a specimen of the early "Preaching Crosses," it is unique. A fine effect must have been produced by a fervid ecclesiastic exhorting a multitude from such a pulpit.



SPANDRIL OF GATEWAY AT ACTON COURT.

On the Rhætic or Avicula Contorta Beds at Garden Cliff, Westbury-upon-Severn, Gloucestershire. By ROBERT ETHERIDGE, F.G.S., F.R.S.E., Palæontologist to the Geological Survey of Great Britain, and Honorary Member of the Cotteswold Naturalists' Club, &c., &c.

READ AT GLOUCESTER, MARCH 29TH, 1865.

THE great interest which has of late been created in the minds, both of Continental and British Geologists, relative to the Rhætic series as a group, and its relation to the two formations above and below, induces me to give to the Cotteswold Club a brief description of these important and remarkable beds, so well exhibited in many parts of Gloucestershire and the West of England, but especially so at Garden Cliff, Westbury-upon-Severn, a well-known headland, two miles east of Newnham, and on the northern side or bank of the river.

It is well-known to most Geologists that the beds of shale, sandstone, and marls, composing the structure of this fine section, and which form the subject of this communication, have been regarded and described as constituting a part of the Lower Lias series, in fact, the base of this argillaceous group so finely developed in the valley of the Severn.

Since the year 1828, when VON BUCH* first under the name of *Gewellien Schicht*, &c., drew attention to the peculiar assemblage of fossils, or Palæontological features of the Rhætic Group, up to the present day; many and valuable papers have appeared, both from the pens of our own countrymen, and from distinguished foreign Geologists. Numerous, also, have been the terms applied to this series of deposits, now recognised through Europe for their importance, and doubts still seem to be entertained as to what name shall be given to them in this country. As a British equivalent, the term "Penarth Beds" has been resolved upon by the Geological Survey of Great Britain; mainly, we believe, from the fact, that the beds of this age are finely exhibited in the headland bearing this name, at the western promontory of Cardiff Roads; and, also, because it holds, or possesses, a distinctive appellation,—there being many Westburys in the kingdom, but only one Penarth.

* Von Buch, *Schicht mit Gewellien auf der Gruber Alp an Eßberge in der bayr. Alpen*, Deutschr akad. Wissensch. Berlin, Jahrg. 1828.

Dr. WRIGHT, of Cheltenham, in 1860,* wrote and communicated an able paper upon these beds, and their development in Gloucestershire and Somersetshire, adopting for them the term "*Avicula contorta* Zone," a name first given to this series of shales and marls in the north of Ireland by Colonel PORTLOCK, † in 1843, and which contain in abundance, this peculiar, and in that age cosmopolitan, shell, *Avicula contorta*, thus specifically named by Col. PORTLOCK from its contorted or twisted form.‡

Mr. CHARLES MOORE, of Bath, in the year 1861,§ wrote a special paper upon the *Avicula contorta* Zone, taking exception to certain views of Dr. WRIGHT, relative to the true position of the White Lias, in connection with, and bearing upon, the classification of this group. This paper of Mr. MOORE's contains good and characteristic figures of the species found in the *Avicula contorta* or *Rhætic* beds in this country.

The complete history and synonymy of this thinly-developed, yet important series of deposits, it is not my intention to enter upon, my chief object being to give a description of the Garden Cliff, or Westbury section, correlating it generally, or in particular instances with others, when necessary, in Gloucestershire or adjacent counties.

The whole valley of the Severn abounds in features of high Geological interest, both to the Physicist and Palæontologist, and I know no portion of England where such varied phenomena may be studied;—where cause and effect, and the ancient and modern physical history of western England, if not Europe, may be more clearly observed;—where the relations of sea and land, and the grand phenomena of denudation through past and successive epochs can be better investigated and understood: for the Cotteswolds yield not to the distant, far-famed Jura, either in physical structure or natural grandeur; every feature in that extensive range being duplicated and typified in the boldly scarped oolitic hills that border the Severn and its extended plain, and which then trend through the middle of England, and lose themselves on the coast of Yorkshire, under the waters of the German Ocean.

It is in the Severn valley, and at several points, viz., Wainlode Cliff, Aust Passage, and Westbury, that these Rhætic beds occur, or are exposed: and at the same level, though remotely situated inland, but still exhibiting the same physical features, are the fine sections of Patchway and Saltford,

* WRIGHT, Quarterly Journal Geol. Society, vol. xvi, 1860, p. 374.

† PORTLOCK, Report on Geology of Londonderry, 1843, pp. 126, 127.

‡ *Gervillia striocurva*, (QUENSTEDT.)

§ MOORE, Quarterly Journal Geol. Society, 1861, p. 483, Pl. 15, 16, on the Zones of the Lower Lias, and *Avicula contorta* Zone.

and nearer home, Coombe Hill. The bold escarpment of Garden Cliff, near the village of Westbury, is composed of beds of three distinct ages, all conformable to each other, and all clearly defined. I say three distinct ages, if we admit that these Rhætic,* or *Riffent* beds, should be considered to be of independent age; because, if our views were based upon and determined purely by stratigraphical and petrological conditions and conformability of strata, we should assign no real and independent position or age to the beds in question, although physically, as well as Palæontologically they are distinct from the underlying and overlying beds, i.e. the Red Marls of the Keuper below, and the limestones and shales of the Lower Lias above. At Garden Cliff, or Westbury, all these conditions are admirably exposed, and nowhere in Gloucestershire are the chief features of the beds comprised in the deposits of this age, so clearly defined; and until the interest excited through research on the Continent, and the papers by Dr. WRIGHT and Mr. MOORE upon these beds in England, Westbury and the Aust Passage series were believed to be the most typical in this country; subsequent research, however, and especially of late by Mr. BRISTOW and myself, have enabled us to critically examine the grand coast sections at Watchett and Penarth, as well as Puriton, Patchway, and other inland and railway sections, with all of which the Westbury beds in the main agree, differing only in those details consequent upon local physical conditions during synchronous deposition.

The entire section exposed at Westbury, including the red Marls, measures about 70ft. The lower 16 feet in the section, down to the mean level of the Severn, consists of six alternating bands of grey and red fissile and conchoidal Marls, (No. 1 in section,) apparently here containing no fossils. These Marls dip 3° S.E.; they correspond in position and age to the same (but lithologically rather different) beds at Watchett, Penarth, and Puriton, at which places I have termed them "Tea-green Marls," from the peculiar hue of the freshly-fractured shales when exposed, and the constancy of their conditions. The intermittent bands of these Tea-green Marls at the above-mentioned sections are remarkable, and worthy of much attention in the sections.

Above these red and grey marls is a band of coarsely conchoidal white and grey marl, (No 2 in the section,) measuring 3ft. 3in. in thickness, more indurated than No 1, which crumbles readily upon being disturbed; succeeding this (No. 3) is a series of Grey Marls having a fine grained

* "Rhætische stufe," a term applied to these beds in Würtemberg by M. Gümbel.

† *Köessener Schichten* von Hauer, *Jahrbuch der Geolo. Reichsanstalt*, 1853, and of Suess, 1854.

structure and conchoidal fracture ; this band measures 14ft. in thickness, and at its upper part, immediately beneath a line of dark and rusty shale, one inch in thickness, (at * in section, base of No. 4,) the remains of fish (coprolites, teeth, scales) were found ; one of the few instances of organic remains occurring below the black shales of the Contorta series having here been determined. Dark shales, comprising bed No. 4, and 1ft. 3in. in thickness, complete the lower marly series. The 16 feet of red, grey, and white alternating Marls, &c., (No. 1 in section,) are of interest only to the stratigraphical or physical Geologist, and *out* of the 35 feet that occur between tide mark and the first fish bed, No. 5, should be classed with the Keuper ; but the beds, Nos. 2, 3, 4, hitherto considered as belonging to the New Red series, I have no hesitation in placing as the base of the Rhætic series at Westbury. Collateral evidence, and equivalent beds, as determined through correlation with other sections, with the occurrence of fish and other remains in these pale grey Marls, fully warranting our throwing the line lower, or farther back in time : the evidence to establish this is seen in all the sections I know, when carefully worked out ; and in this country these upper Marls are the equivalents of the Tübingen Sandstones and marls of QUENSTEDT.

We now commence the true Contorta Zone or Black Shale series at Westbury Cliff, those beds known to older Geologists as the "Bone Beds,"* and so well seen here, as well as at Aust Passage and Coombe Hill, &c. A marked change occurs at No. 5, the first hard bed in the section, and also the first in which may be found an *assemblage* of fossils, continuously or universally distributed through the sandy matrix. It is indeed, the *first* Bone bed, and in which occur the scales of *Gyrolepis Albertii*, Ag., teeth of *Saurichthys apicalis*, Ag., small *coprolites*, and fragments of the enamelled teeth of *Sargodon tomicus*, Plein., with casts or moulds also of *Pullastra arenicola*, Strickl.: and *Avicula contorta*, Portl.—their first appearance in the beds of this section. This Sandstone bed is divided into two portions, the uppermost layer being 3 inches in thickness, and the lower 2 inches ; and in this lower part it is that the fish remains occur. The entire bed is a micaceous Sandstone, in places pyritic, and is conspicuous in the cliff as the lowest of the two Pullastra Sandstones known to most local observers. This first fish bed (No. 5) should be termed or known as the "Micaceous Bone bed."

Resting upon the rather uneven surface of this Sandstone is a succession of dark grey fissile sulphurous shales 1 foot 10 inches to 2 feet in

* Schwäbische Kloake of QUENSTEDT.

thickness, (No. 6 in section,) in which I failed to find any organic remains; but the rapid decomposition of the iron pyrites, disseminated through the shales, on exposure to atmospheric influences, is so powerful an element of destruction, that fossils are rarely found in beds of this character, unless the shales are deeply cut into. The succeeding bed of hard dark grey micaceous Sandstone (No. 7,) is a conspicuous and prominent feature along the face of the cliff, especially near the centre of the section, standing out in a step-like ledge beneath the superincumbent mass of black and dark Cardium shales. The upper surface of this thick Sandstone is ripple marked, the rippled grooves being nearly at right angles to, or lying across the direction of the dip of the bed; in other words, they are parallel to the strike of the beds on which they occur. With little variation, this zone measures 12 inches in thickness, but has, like No. 5, a parting near the base, dividing it into two portions. This well-defined horizon in the cliff has been, and is well designated, the *Pullastra Bed or Zone*, from its being so crowded with the casts of that ubiquitous and cosmopolitan shell, *Pullastra arenicola*, Strickl.; for, at every section where these beds are exposed, it is ever present, and in the same position, thus determining the range in time and space these beds occupy; and the same remark may apply equally well, to the *Avicula contorta*, Portl., and *Cardium Rhæticum*, Merian., of this group of rocks. Coprolites and Fish Scales occur at the base, or in the lower part of the bed, below the parting, thus relatively occupying the same position as in the thinner Pullastra bed below (or Micaceous Fish Bed, No. 5, bottom part.) Fresh fractures along the plane of bedding or deposit, reveal the species:—

Cardium Rhæticum, Merian.

Modiola minima, Sow.

Avicula contorta, Portl.

Pullastra arenicola, Strickl.

Axinus or *Schizodus*,

the Pullastra being the most numerous, but all chiefly occur in the form of casts, though well defined. The weathered surfaces of fallen slabs, or tabular blocks from the same bed, strewn over the shore, also shew the same species clearly defined, with other indeterminate and equivocal forms. This bed is, and will always present an important horizon in the structure of the cliff, one recognisable by all, and constitutes a good datum line for measurements, and a clear starting point for the succession of the beds above or below; as well as affording data for the correlation of these beds on the same horizon in other and distant sections in Gloucestershire and adjacent counties; but in the character of a hard and

micaceous Sandstone bed of any thickness, over any large area, it does not appear persistent. At Aust, it is not recognised in the form of a Sandstone bed, but as indurated arenaceous shales containing the same shells, and at Wainlode Cliff, as the light-coloured Sandstones of the Bone bed series—associated with *Avicula contorta*.

We now commence the true Bone bed series, or the group of the black shales, in which are two, if not three, well defined but irregularly formed bands composed of Bone breccia, in a matrix of Pyritic and Micaceous Sandstone, containing the bones, teeth, palates, and coprolites of Fish and Saurians.* This black shale series may be divided into three sets of beds, measuring together 8 feet 8 inches, the Upper and Lower Fissile Shales in the group being divided by the well-known "Bone bed" No. 9,† which does not measure more than from 1 to 1½ inches in thickness. They will read thus: upon the Pullastra bed No. 7 rests a series of black shales, measuring about 18 inches, with a thin Pyritic Bone bed, or band, less than 1 inch thick, in the upper one-third; and above this line of Bone breccia occurs another series of shales, 6 inches, also lined with traces of indurated shale, having Fish remains scattered over and through the thin lenticular masses. Together this constitutes bed No. 8 *in section*, and which is capped by the Bone bed proper, or known as such, and which for convenience and distinctiveness is marked bed 9; and we must not fail or omit to recognize in this singular and remarkable Bone breccia, during the time it was under accumulation, some very important considerations relative to the condition of the sea, and shore, or land between tide-marks and deeper water, and especially so when we see (in Western England at least) its wide distribution in space, and its persistency in time; for both these conditions seem to have been fulfilled as regards the precise horizon of this Bone bed during the deposition of these particular Argillaceous or sandy shales, with which it is intercalated and so intimately associated. Its position at Aust Passage, Wainlode Cliff, Coombe, Pyle Hill, Uphill, Puriton, Charlton near Lyme Regis, &c., on the eastern side of the Bristol Channel, and its continuity on the western side at Penarth and places on the same coast, and the West of Europe, fully attests the wide area over which it extended and was deposited, and with such persistent and

* Sir PHILIP EGERTON, in the year 1841, was one of the first to propose that these shales should be classed with the Keuper Marls, purely upon palaeontological grounds, thus anticipating by 24 years the question now occupying so much attention.

† Schwäbische Kloake of QUENSTEDT.

similar conditions. This correspondence in time, its "Homotaxia," would seem to imply that this extended area must have occurred or existed as a shallow sea, in which the numerous vertebrate occupants have left to us their scattered remains and testimony, and also that it was not by currents or drifting, that these bones could have been carried and sorted where they now occur, but were regularly deposited and bedded in the position they now occupy. I am thus induced to believe, from the peculiar relations which exist between the organic remains and the associated physical conditions, that this chief Bone bed was synchronously deposited over the area it now occupies in the West and South-west of England. The dying out or extinction of the species contained in, and peculiar to the beds of this age, would indicate synchronous and similar conditions of change in the relative positions of land and sea: and in the case of the Bone bed, I am induced to believe that it was accumulated during a period of slight elevation, as the sub-angular pebbles or nodules contained in, and comprising much of the bed in some localities, is re-constructed new Red Marl; and especially is this the case at Aust Passage, where the bed attains a thickness of about 9 inches, three-fourths of which is a marly conglomerate. The Westbury bed, however, is chiefly and purely Bone breccia, and is the richest in the remains of Saurians and Fish, and their excrementitious matter, with which I am acquainted; although at the northern extremity of the Aust or Old Passage section, where mixed with the white and grey nodular marls, it attains the thickness, as before stated, of 9 inches. The organic remains of this Bone bed are:—

<i>Acrodus minimus</i> , <i>Ag.</i>	<i>Sargodon tomicus</i> , <i>Plien.</i>
<i>Nemacanthus filifer</i> , <i>Ag.</i>	<i>Plesiosaurus</i> , vertebræ of
———— <i>monilifer</i> , <i>Ag.</i>	<i>Ichthyosaurus</i> , vertebræ and femur
<i>Hybodus minor</i> , <i>Ag.</i>	<i>Pullastra arenicola</i> , <i>Strickl.</i>
———— <i>pyramidalis</i> , <i>Ag.</i>	<i>Axinus cloacinus</i> , <i>Opp.</i>
<i>Gyrolepis Alberti</i> , <i>Ag.</i>	<i>Avicula contorta</i> , <i>Portl.</i>
———— <i>tenuistriatus</i> , <i>Ag.</i>	<i>Ceratodus</i> . *
<i>Saurichthys apicalis</i> , <i>Ag.</i>	

Succeeding this definite horizon are a series of dark brown shales, about 7 feet in thickness, No. 10 *in section*, the upper half being darker in colour than the lower, and weathers with a more rusty appearance. This division between lower and upper is determined by an indurated

* I did not find the remains of *Ceratodi* here, although they abound at Aust. Dr. WRIGHT states in his *sic loc. cit.* that it occurs in the Bone bed at Westbury; I therefore give it on his authority, which I do not doubt.

band running through the shales. For distinctness' sake and on Palæontological grounds I term these the *Cardium shales*, as the paper-like laminæ are literally full of the compressed valves of *Cardium Rhaeticum*, associated, though sparingly, with

Pullastra arenicola, *Strickl.*

Pecten Valoniensis, *DeFr.*

Axinus or *Schizodus*.

In no part of the section do we find so many individuals of the species of *Cardium Rhaeticum* as in these dark shales; and the physical characters of these two series are sufficiently well marked to admit of my describing them as two distinct beds. The dark Fissile beds 8 and 10, divided by the Bone bed, if taken as one, would measure 9 feet 2 inches, but physical conditions and organic contents require us to divide them for intelligible reasons and easy recognition; and the same holds good on the ascending and succeeding shales, (No. 11 in section,) which are dark grey and marly, weathering into pale grey, and having here and there intermittent thin bands of fine grained Pyritic Sandstone. (See section.) This series measures 2 feet 6 inches, and contains a large number of the shell *Avicula contorta*, Portl., and I would name these the *Contorta shales*, in conformity with naming No. 10 the *Cardium shales*, for physically and Palæontologically they differ. In this group, associated with *A. contorta*, occurs a small *Axinus*, and *Cardium Rhaeticum*, and a thin calcareous band, with fragments of *Pecten Valoniensis*, DeFr.

Capping these grey shales we have the true position of the Lower Pecten bed, here represented by a thin, yet well-defined grey calcareo-argillaceous drab-coloured Limestone band, about 1 inch in thickness, containing perfect shells and casts of *Pecten Valoniensis*. The position of this apparently insignificant lamina at Westbury Cliff is on precisely the same horizon as at Coombe Hill, Patchway, Aust Passage, and Penarth, here characterised by an excess of lime in its composition; at other sections it is mostly a Pyritic Limestone of extreme hardness. This irregular line is marked *a* in the section between beds 11 and 12, and which I make a distinguishing feature and line of demarcation between the two beds of shale, as well as tending to fix or determine the place of the two Pecten beds, or the lower and upper, which here as elsewhere occur, but separated in the section by the shales No. 12, 2 feet thick.* In these shales I failed to detect any fossils, although the

* I know of no section in this group of deposits in the West of England in which these two Pecten bands do not occur.

indurated seams or lines running through the band would indicate their presence. The upper Pecten bed, on the top of No. 12, and about $1\frac{1}{2}$ inches in thickness, (*b* in section,) closes the upward succession of the Black Shales. At Coombe Hill the shale between the lower and upper Pecten beds is 8 feet in thickness, at Aust Cliff 6 feet, and Patchway 7 feet. The shells are numerous in the upper Pecten bed, which is well defined, and easily recognised by the lenticular but continuous masses of pale brown earthy argillaceous Limestone, looking like indurated mud. I obtained a remarkably fine centrum of Plesiosaurus from this thin band when constructing the complete section of the cliff. A change takes place in the character and colour of the marls and shales above the black series, both on lithological and Palæontological evidence; the fossils are better preserved, and we have also a larger assemblage of Mollusca, both specifically and numerically. Dr. WRIGHT, in his valuable paper upon the Zone of *Avicula contorta*, &c.,* notices this series, and reading downwards, places it in his section as No. 6, stating that it contains "many compressed Conchifera which have not been determined." This is bed or series No. 13 in my section, and which measures 7 feet, but in places may be more, owing to the irregular capping, and peculiar nature of the Estheria Zone above. I regard these grey conchoidal marly shales as the most fossiliferous series in the *Avicula contorta* zone at Westbury, but from their position in the cliff, have perhaps been little worked or examined. I obtained, in a very short time, through the assistance of our valued and old associate, JOHN JONES, Esq., the following species from these beds:—

Pecten Valoniensis, *Defr.*

Cardium Rhæticum, *Merian.*

Axinus cloacinus, *Opp.*

Anatina Suessii, *Opp.*

Lima precursor, *Quenst.*

Axinus or Schizodus.

Myacites musculoides, *Schl.*

Avicula

Pleurophorus angulatus, *Moore.*

Modiola minima, *Sow.*

Trigonia †

and numerous casts of indefinite and doubtful forms.

The uppermost part of this marly series culminates in a densely hard grey crystalline Limestone, irregularly bedded, 3 to 5 inches in thickness, (*c* in section,) and in which is crowded most of the Rhætic species enumerated above. It is the only band of fossiliferous crystalline Limestone in the whole section beneath the Monotis beds above, whereas

* Quarterly Journal, Geological Society, vol. xvi, p. 374.

† These all occurred in the condition of sharp casts and moulds, the true shell being seldom preserved.

the Pecten zones at Aust, Penarth, Watchett, and Uphill, &c., are composed entirely of hard grey crystalline, and sometimes Pyritic Limestone, with numerous other species crowded into the same bed; indeed it is remarkable that, compared with other localities, the absence of Lime is a marked feature in the Westbury section.* We now arrive at a singular and interesting bed (No. 14 in section,) most irregularly constructed, and varying in conditions, being nodular or septariform, intermittent, or lenticular, yet continuous, and apparently incorporated with the crystalline Limestone band just mentioned, but above it, or at times apparently reposing upon the denuded surface of the grey marls, No. 13. This is the *Estheria* Zone; and is, I believe, the culminating point of the minute species of Crustacea, giving rise to the name of the bed or zone, and so called from the universal distribution of *Estheria minuta* on the same horizon through Great Britain. And, it must be noticed, that no marine forms occur, or are associated with this Crustacean in these creamy marls at Westbury, or in marls of the same age and position, and similarly constructed, at Coombe Hill, Wainlode Cliff, Aust Passage, Pyle Hill, Knowle Hill, and Bedminster Down, near Bristol; at all of which places, as well as sections in Warwickshire, these white marls, containing *Estheria minuta*, occupy the same relative position.

At Westbury, this bed forms a conspicuous band in the cliff, from its whiteness and irregular character, and is from 4 to 18 inches in thickness. In structure it resembles hard grey Chalk, or white smooth earthy Limestone, and the *Estheriæ* occur in nests or nodules, which lie in the many laminations of the bed, and the whole on the irregular or eroded shelly crystalline Limestone above mentioned.† The equivalent of this bed and its *Estheriæ* in cream colored marl 4 inches thick, and other beds above, I observed last summer, when constructing my section at Coombe Hill, the *Estheria* marl there resting upon 15 feet of dark brown Shales, both of which seem to have escaped the observations of former investigators, and, which adds considerable interest to the Coombe Hill Section, increasing the thickness of the Rhætic beds there, to 35 instead of 15 feet,—i.e. 20 feet more are added to the upper black Shales and *Estheria* group; or, if we take in (which we must do) the grey, and red,

* These facts will clearly appear on the completion of the sheets of comparative vertical sections now being drawn and prepared by MR. BRISTOW and myself, illustrating the Rhætic series of the West of England.

† The importance of this group of Crustacea (Limnadidæ) in time, and of this species in particular, is admirably detailed by Professor RUPERT JONES in the Palæontographical Soc. vol. for 1860, pp. 42—78.

and green marls, 25 feet extra will be extracted from the upper part of the Keuper, and added to the now-called Rhætic above, thus making the Coombe Hill section 60 feet in thickness. The *Estheria* band is succeeded by two well-marked series of clays and marls, Nos. 15 and 16, which physically differ so much, as to demand distinct recognition, and which must be divided to be understood. The lower group, (No. 15 in the section,) consists of grey fissile marls with numerous thin pyritic Limestone bands containing few fossils. These marls give good evidence of having then accumulated under estuarine and shallow water conditions. I searched for *Estheria* in the thin calcareous bands which are associated with the marls, but failed to detect any; and it appears to me, that here, as well as at all other sections where the *Estheria* Zone is defined, that the white marly band below (No. 14) is the uppermost limit of the distribution in time, of this gregarious species of the Phyllopod *Limnadiæ*, *Estheria minuta*.

No. 16 is composed of numerous beds of indurated, brown, clayey, shaly marls. Fish scales and teeth are scattered through the series, and especially so about the middle of the beds, where a tolerably well-defined indurated band indicates their presence abundantly; and this horizon is more fissile than the portions above and below. Dividing bed 15 from 16 is a thin rusty band evidently possessing an excess of pyrites, and which clearly divides the grey pyritic Shales, No. 15, from the argillaceous Clays, No. 16 above, at the top of which, new features, both physically and Palæontologically come in and carry us up to those conditions, so familiar to all, as occurring at the base of the Lias. This change is first indicated by the presence of an indurated bed of cream-coloured, marly, argillaceous Limestone, (No. 17 in section,) composed entirely of *Myacites Musculoides*, Schl., and *Modiola minima*, Sow., and although only two inches in thickness, this bed will always be of interest, from the abundance of these two species contained in it. Above, and united to this by a slight parting at its upper surface, is the well-known *Monotis* bed, No. 18, kept distinct from No. 17 on Palæontological grounds. This zone, although only three inches in thickness, is so important and well-defined that it demands especial notice; the thin fissile Limestone slabs which, united, make up the measurement of the three inches, are literally crowded with the small but beautiful *Monotis* (*Avicula*) *decussata*, Goldf.; it is here ubiquitous, occurring in thousands over the surface of the slabs. The matrix in which they are embedded is as smooth and even in its texture, as the lithographic stone of Solenhofen, and has the conchoidal fracture peculiar to this and the Cotham marble;

and I have long believed that these two thin bands, Nos. 17 and 18, are the equivalents of the Cotham marble, at Saltford, Cotham, Patchway, and some other places. But more especially to define the horizon of the Monotis and Modiola series here, I believe we may parallel the four beds, Nos. 17, 18, 19, and 20, with the White Lias series; for, thin as they are, yet from observations made at other sections, I have confidence in assigning to them the position, and that they are the representatives of what is now regarded as the White Lias of typical localities. Again, the lower or Myacites band, and the Monotis Limestones have every element in them, both as regards position, petrological structure, and organic contents, under the modifying agencies due to alternations of level and other physical conditions, to induce us to parallel them in time with the White Lias, and which are succeeded here, as elsewhere, by the true *Ostrea liassica* beds above; these beds, Nos. 15 to 20, are of great interest, and we have yet to learn much respecting them, through correlation with other sections, especially those of Aust Passage, and Patchway on the Bristol and South Wales Railway, or New Passage Line, where these grey and white Limestones* for many miles determine the spread of the Rhætic series, and the uneven or eroded surface of the Cotham marble at Patchway, although only three inches thick, faithfully chronicles through its conservative character, and the persistency of similar conditions at the close of the black Shales and marls, at Westbury section, how it has resisted the powerful effects of denudation, and preserved to us from destruction the soft and pyritous shales below.*

The species found in these two thin but important bands, viz, the Monotis and Myacites beds, Nos. 17 and 18, are the following:—

- Myacites musculoides*, *Schl.*
- Modiola minima*, *Sow.*
- Anatina*
- Monotis (Avicula) decussata* *Goldf.*
- Cardium Rhæticum*, *Merian.*
- Ostræa liassica*, *Strickl.*
- Libellula*, wing of

* The Grey Marls and Argillaceous Limestones at Aust Passage, attributed by some to the Zone of *A. Planorbis*, belong instead to the horizon of the Monotis and Myacites marls, at Westbury, and the "lowest Limestone therein mentioned is the locally peculiar Cotham marble, which contains the Elytra of Coleoptera, wings of insects, and scales, and perfect fish of *Legmonotus Cothamensis*, Eg., and *Pholidophorus Higginsii*, Strickl.

The thin brown shales, No. 19, which measure 18 inches, contain only the scattered scales and remains of Fish over their several laminae, and serve to distinguish and separate the *Modiola minima* bed, No. 20, from those immediately below. This uppermost bed in the Rhætic series at Westbury Cliff is a dull pale brown or grey hard Limestone, with *Modiola minima* and *Ostrea liassica* abundantly distributed through it. So closely allied to the Lias in character is this Limestone, that it requires us only to find an Ammonite to determine it to be of Lias age.*

The generalizations deducible from the foregoing brief description of the strata and organic remains and their conditions at Garden Cliff are numerous and important, more so perhaps than we are at first disposed to believe; and it is obvious, from the amount of interest which these Rhætic beds and the whole subject has of late created, that much diversity of opinion will and must exist with relation to the true history of these beds in time, especially when we consider that we have not perhaps in England, *in one section*, a complete sequence of the whole series, both as regards the life or organic contents, or the physical conditions by which to estimate or correlate with continental sections:—but the physical condition we cannot expect to obtain, owing to the varied phenomena attending deposition of sedimentary matter over large portions of the earth's surface, and which diversity must necessarily occur, and operate to prevent a uniform condition of things over wide spread yet continuous and connected areas. On the other hand we may, however, understand, through strict research and patient analysis, the life succession, and distribution of the species in time, constituting the fauna of this group of remarkable rocks. For it is certain that in England, with few exceptions, we possess most of the forms known to occur in beds of this age in Europe, thus clearly defining that the Rhætic species, as regards their distribution in space, had a very wide range, and at the same time demanding from us extended notions of time for the dissemination or distribution of the species over a large portion of Europe, and perhaps Asia; and looking at the cosmopolitan distribution of such forms as *Avicula contorta*, *Pecten Valoniensis*, *Cardium Rhæticum*, *Pullastra arenicola*, &c., and their ubiquitous condition, or vast abundance individually in the rocks, both in our own country and Europe, and their definite arrangements in zones almost illustrating epochs, demand and

* A most remarkable zone in the Patchway district, its upper part being highly fossiliferous; *Pholodomya glabra*, *Unicardium*, *Ostrea liassica*, *Modiola minima*, *Lima*, a *Cardium* (nov. sp.) all occurring in great abundance.

claim from us continued exertions to investigate both the physical condition of the rocks and history of the species; and again, I know of no series of beds which determine to us the secular movements, or gradual oscillations of land, and relatively the water, than these transitional accumulations during late or post-Triassic or pre-Liassic age.

The group of rocks, and section at Westbury, help us by their geographical position, as well as geological horizon, to examine and understand the conditions of the Keuper Marls at their close, and the succeeding and allied Rhætic series upon them, and also the base of the Lower Lias, as evidenced by the Planorbis Zone at the summit of the cliff and seen in position, at its junction with the Transitional or Rhætic Zone below.*

It is also one of the few places where evidence is clearly afforded which may guide us to a right understanding of the many fluctuations and recurring uniformities, arising from slow oscillation of the land, and deposition of organic and inorganic matter, and the corresponding development of life in an estuarine, or shallow sea. For I cannot conceive that the Rhætic series could have accumulated, or have been deposited under any other conditions, than on a slowly-descending sea bed, and repeated pauses (as evidenced by the numerous Bone beds and crystalline lime bands), extending over great intervals of time, which thus gradually and steadily produced the alternating conditions so manifest in the physical structure of the shales, marls, and thin limestones of the beds comprising the structure of *this* section in particular and others generally.

DISTRIBUTION.

This thin, and to some apparently insignificant section on the banks of the Severn, at Westbury, as well as two or three others which occur in the magnificent valley watered by this grand river, are English types of the extensively developed rocks of the same age and physical aspect, in Austria, Lombardy, France, Hanover, Savoy, Saxony, Bavaria, and Switzerland, &c.; and although with us the series is never found to exceed one hundred feet in thickness, including (according to our new reading) the grey, green, and white marls of the Upper Trias, yet the fact of its highly developed Palæontological features agreeing in almost every essential character with the Continental deposits, enables us to co-ordinate through its Fauna, the entire series in this country with those of Europe

* The only complete series exhibiting all these groups in succession is seen near Watchett, where every bed, from the Tea green Marls of the Upper Trias, to the Bucklandi Zone, is measurable in one cliff section.

just mentioned, as well as tending to establish and confirm the grand generalizations, consequent upon clear determination of the distribution of species over given areas in unlimited time. In England, as in the Northern latitudes of Europe, (in Sweden, Norway, Bohemia, and Hungary,) this formation is known only as a thin zone; whereas in Southern Europe, in the Alps and in Lombardy, &c., it attains an enormous thickness, nowhere wanting or devoid of life or organic remains, in some regions possessing a peculiar "assemblage of forms, the bones, teeth, and spines, &c., of fishes, as at Würtemberg and Northern Germany, &c.; in another typified by, and crowded with, bivalves, as in the Bavarian Alps, Lombardy, and France; elsewhere, as in Sweden, Franconia, and, perhaps, also the 'Gresten beds' of the Alps, remains of plants abound;" but everywhere the *Avicula contorta*, which shell is cosmopolitan in the strictest sense. In Saxony and Hanover, it attains considerable thickness, associated with bone beds and breccia like our own at Westbury.

Thus, then, are these beds at Garden Cliff, the equivalents and representatives of one of the most remarkable deposits in Europe; and the student may here acquaint himself with all the main facts of the group, so far as they are to be met with in this country. Each month brings out and establishes fresh evidence of its originally wide-spread condition over the west and centre of England, and its intimate relationship to the grand mid-European deposits in the plains of Lombardy, and the gorges and slopes of the Great and Bavarian Alps. The coast of Londonderry and Antrim, in Ireland, gives unequivocal proof of its having once occupied an immense area, now covered by the waters of the North Atlantic, or buried beneath the ancient Lava flows and Basaltic Columns that form the coast line of the great Causeway. An irregular but clearly defined line traceable from Redcar and the bold headlands on the Yorkshire coast, to the cliffs of Dorsetshire, attests its continuity through our own Island, yielding and exhibiting to us on its way, through the varied but constant agency of denudation, the magnificent sections at Watchett, Penarth, Westbury, Aust and Axmouth. The English Channel flows over that area whose western boundary line stretches from Lyme Regis to Cherbourg, Valognes, and Caen. In Southern France its lines are traceable from Montpellier to Lyons, Charolles, and Nevers; thence north-east to Nancy, Thionville, and on to Luxemburg. From Basle and the flanks of the Jura, to Stuttgart, Bamberg, Coburg, and Baireuth, its shells, sandstones, and shales, are easily determinable. All along the Bavarian Alps, from Feldk near the Rhine, to Salzburg, Gresten, and Vienna, they occur in vast deposits constituting whole mountain ranges. In the northern parts of the plains

of Lombardy, from Como; Azzarola, and Temezzo, to the Lake of Garda they are also grandly developed ; and now illustrated by the pen and labours of the accomplished STOPANI.

In the north of Europe, and corresponding to our own beds, they range by Osnabrück, Minden, Hildersheim, and the Island of Bornholm in the Baltic, thus occupying an area from the South of Norway, to Lombardy and Montpellier, in the South of France ; from Derry and Antrim, in Ireland, the Severn and Axmouth on the west, to Vienna, at the eastern end of the Bavarian Alps, on the east ; and I doubt not from specimens I have examined from India, that the flanks of the Himalayas possess them also.

Let us then, from this remnant and insignificant outlier at Garden or Westbury Cliff, and to which I have merely drawn attention, learn to estimate the value and importance of local sections, as linking us by correlation and research to those distant and more completely developed masses which constitute a fragment of the structure of Europe, and to which we must refer for the solutions of certain problems and connecting links in time and space, and which the Severn Valley illustrates through this one section, as well as other geological phenomena through its length and breadth.

(For tabular arrangement of the distribution of species see other side.)

**GEOGRAPHICAL TABLE,
EXHIBITING THE DISTRIBUTION OF THE RHÆTIC SPECIES
IN THE COUNTY OF GLOUCESTER.**

SPECIES.	LOCALITIES.					
	Coombe Hill.	Walsode.	Woolbury.	Aust.	Tortworth. †	Patchway.
<i>Libellula</i> , wing of
<i>Plesiosaurus</i>
<i>Ichthyosaurus</i>
<i>Acrodus minimus</i> , Ag.
— <i>acutus</i> Ag.
<i>Hybodus plicatilis</i> Ag.
— <i>minor</i> Ag.
— <i>pyramidalis</i> Ag.
— <i>raricostatus</i> Ag.
<i>Gyrolepis Albertii</i> Ag.
— <i>tenuistriatus</i> Ag.
<i>Sargodon tomicus</i> Plien.
<i>Saurichthys apicalis</i> Ag.
— <i>longidens</i> Ag.
<i>Nemacanthus filifer</i> Ag.
— <i>monilifer</i> Ag.
<i>Ceratodus altus</i> Ag.
— <i>curvus</i> Ag.
— <i>dædalus</i> Ag.
— <i>emarginatus</i> Ag.
— <i>gibbus</i> Ag.
— <i>latissimus</i> Ag.
— <i>obtusus</i> Ag.
— <i>parvus</i> Ag.
— <i>planus</i> Ag.
— <i>trapezoides</i> Ag.
<i>Axinus cloacinus</i> Opp.
<i>Avicula contorta</i> Porth.
<i>Lima precursa</i> Quenst.
— <i>pectinoides</i> Sow.
<i>Modiola minima</i> Sow.
— <i>minuta</i> Goldf.
<i>Monotis decussata</i> Goldf.
<i>Myacites musculoïdes</i> Schlot.
<i>Pecten Valoniensis</i> Deffr.
<i>Cardium Rhæticum</i> Merian
<i>Pullastra arenicola</i> Strickl.
<i>Ostrea liassica</i> Strickl.
<i>Pleurophorus angulatus</i> Moore
<i>Estheria minuta</i> Bronn
<i>Axinus elongatus</i> , <i>Anatina Suessii</i> , and <i>Placunopsis</i> occur in a hard grey crystalline Limestone at Aust Passage.

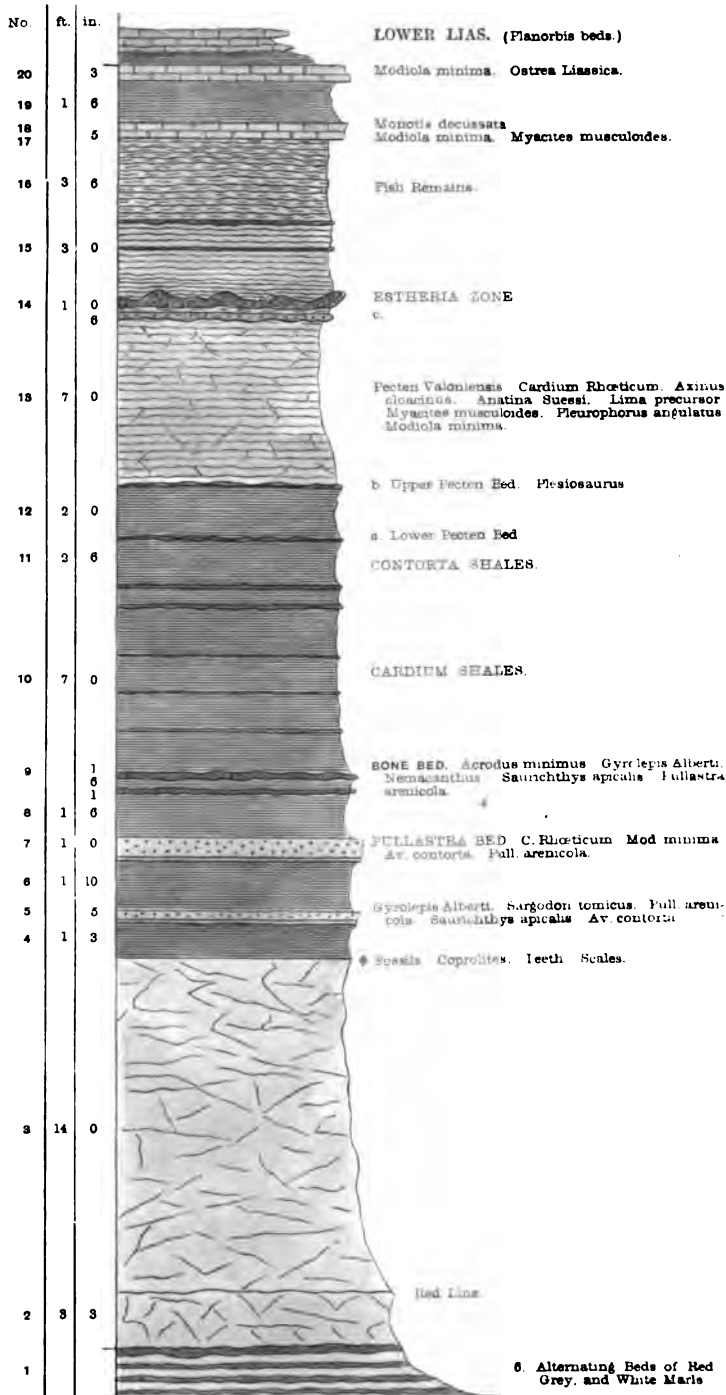
On the authority of Dr. Wright

At Saltford also

† The Rhætic series at Tortworth rest upon the mountain Limestone, and were determined some years ago by the Earl of DUCIE, whilst draining 4 feet deep in the Park; and who drew my attention to the Bone Bed.

Numerous undescribed and doubtful species occur in the marly series, No. 13 in section.

RHÆTIC SERIES.



On the Ammonites of the Lias Formation. By THOMAS WRIGHT, M.D.,
F.R.S.E., F.G.S. (Continued from page 179.)

AMMONITES CONYBEARI, *Sowerby*. (Pl. 3, fig. 2, 3.)

- A. CONYBEARI, *Sowerby*, Mineral Conchology, tab. 131, p. 70, 1816.
- " *Sedgwick & Murchison*, Trans. Geol. Soc. Lond., 2nd series, vol. 3, p. 312, 1830.
- " *Zieten*, Die Versteinerungen Württembergs, tab. 26, fig. 2, 1831.
- " *Hoffman*, Karstens Archiv. 13, p. 267, 1840.
- " *Zeuschner, v. Leonhard, und Bronn's Jahrbuch*, p. 429, 1842.
- " *d'Orbigny*, Paléontologie Française ter. Jurassique, pl. 50. p. 202, 1843.
- " *Pilla*, Saggio compar. dei ter. d'Italia, p. 70, 1845.
- " *Lardy, v. Leonhard, und Bronn's Jahrbuch*, p. 210, 1846.
- " *Ezio de Vecchi*, Bulletin Soc. Geol. Fran., 2nd series, tom. 4, p. 1079, 1847.
- " *Quenstedt*, Cephalopoden, p. 80, tab. 3, fig. 13, 1849.
- " *Savi e Meneghini*, Consider. sulla Geol. della Toscana, p. 72, 1851.
- " *Buch, v. Leonhard, und Bronn's Jahrbuch*, p. 316, 1851.
- " *Renevier*, Bulletin de la Soc. Vaud. sci. nat. tom. 3, p. 139, 1852.
- " *Merian*, Verhandlungen der naturf. Ges. in Basel, p. 151, 1852.
- " *Escher, v. Leonhard, und Bronn's Jahrbuch*, p. 167, 1853.
- " *Studer*, Geologie der Schweiz, vol. 2, p. 30, 1853.
- " *Oppel*, die Juraformation, p. 69, 1856.
- " *Hauer*, über die Cephalopoden der nord. Alpen, tab. 2. p. 16, 1856.
- " *Quenstedt*, der Jura, p. 78, 1858.

Diagnosis.—Shell discoidal, much compressed; back tricarinated; whorls numerous, 8 to 10, slightly involute and numerously costated; costæ in adults from 40 to 60 in a whorl, small, round, obliquely arcuate, and

interrupted, terminating at the outer carinæ; back rounded, with a large prominent obtuse keel, bounded by two deep sulci and two external lateral carinæ; aperture oblong, nearly quadrate.

Dimensions.—Transverse diameter, $10\frac{1}{4}$ inches; height of aperture, 2 inches; width of aperture, 2 inches. Specimens measured by M. HAUER, $3\frac{1}{2}$ inches diameter; height of the last whorl, $\frac{2}{3}$; width, $\frac{2}{3}$; diameter of the umbilicus, $\frac{6}{100}$ of the diameter of the shell.

Description.—This is one of the most characteristic and widely distributed species of the zone of *Ammonites Bucklandi*, as shown by the table of synonyms prefixed to this article. Its form in general is very persistent, and its specific characters are subject to fewer variations than most of its congeneric forms. The specimen I have figured was obtained from the same locality as the type drawn by SOWERBY, namely, the Bucklandi beds of Weston, near Bath, from cuttings made during the formation of the Great Western Railway. Another very fine typical example, collected at the same time and from the same locality, is contained in the British Museum. "It measures 18 inches in greatest diameter, and 4 inches across its last chamber in thickness; eight whorls are capable of being counted, but the innermost portion is not capable of being made out." Mr. HENRY WOODWARD, F.G.S., has kindly given me these measurements.

The adult shell consists of from eight to ten slightly involute whorls, about the width of their height; the inner whorls are nearly all entirely exposed, the turn of the spire only concealing a portion of the back. The sides are convex and costated. The ribs are simple, narrow, obtuse, and slightly arched, and disappear at the outside of the lateral carinæ, near the dorsal sulci; they are numerous, and increase with the diameter of the shell; in the specimen I have figured there are 68 ribs in the outer whorl; in general terms the number may be said to range from 40 to 60.

The back is broad and provided with a large obtuse prominent keel; on each side thereof is a deep sulcus bounded by an outer carina, so that the back of this shell is tricarinated with two sulci.

The spire is composed of whorls, with convex costated sides nearly fully exposed, the outer whorl having a strongly developed tricarinate back.

Mouth aperture, nearly quadrate with rounded angles. The septæ, according to d'ORBIGNY, are symmetrical, foliated on each side, and divided into two or three lobes formed of nearly equal branches. *Dorsal lobe* much longer and as wide as the superior lateral lobe, formed of a single

narrow branch with four double digitations. *Dorsal saddle* much larger than the superior lateral lobe, and unequally divided by an accessory lobe (pl. 3, fig. 3 a.) *Superior lateral lobe* formed of nearly symmetrical parts, the external branch sometimes provided with acute elongated digitations. *Lateral saddle*, narrow, irregular. *Inferior lateral lobe*, provided with two unequal branches. Sometimes there is a small auxiliary lobe. The line of the central ray setting out from the extremity of the dorsal lobe passes beneath all the other lobes.

The following important observations were made by the late M. d'ORBIGNY,* on the development of *A. Conybeari* :

"This species is smooth only up to the diameter of 2 millimètres—rarely it remains so up to 3. It afterwards develops ribs similar to those of adult age, and has a small keel without lateral sulci ; at the diameter of 12 millimètres it has often 36 ribs ; at the diameter of 19 millimètres, 46. In others this number augments less, and that upon the less compressed specimens with large whorls. Upon these, for example, at the diameter of 55 millimètres, there exists only 35 to 40 ribs ; upon individuals of 100 millimètres to 198 millimètres, there were 66 ribs. In all the cases the lateral sulci on each side of the keel were not developed on the specimens observed up to the diameter of 30 millimètres. These differences in the number of the ribs and their proximity or separation seem to appertain to the sexes, the shells with numerous ribs being probably those of the males. The lobes from early age have very nearly the same form. From the examination of a very large specimen it appears that ribs disappear in extreme old age."

Affinities and Differences.—This species resembles *A. Kridion*, Hehl., from the Lower Lias, and figured in ZIETEN's *Petrif. de Würtemberg*, tab. 3, fig. 2, and in d'ORBIGNY, *Paléontologie Française*, tab. 21, fig. 1-6. It is distinguished however from *A. Conybeari* by having fewer ribs, and these being more sharp and straight, and terminating in a prominent process near the back ; the keel is more acute, and there are neither lateral sulci nor carinæ ; the dorsal and lateral saddles have likewise a different form, and the phases of development of *A. Kridion*, according to d'ORBIGNY, are very different from those of *A. Conybeari* ; the shell of the former remaining much longer in the embryonic state without ribs.

Locality and Stratigraphical Position.—This is a very characteristic shell of the Lower Lias. I have collected it from the zone of *Ammonites Bucklandi* in the deep cuttings of the Bristol and Birmingham Railway near Bredon, at Fretherne on Severn, Coombe Hill, and several other

* *Paléontologie Française* ter. Jurassique, tom. 1, p. 204.

localities in Gloucestershire; Weston, near Bath; Saltford, near Bristol; Lyme Regis; and Robin Hood's Bay, Yorkshire. Mr. JONES found it at Purton on Severn.* *Foreign Localities*.—It characterises the Lower Lias in the zone of *Gryphaea arcuata* in many Departments in France, as Cher, Jura, Ain, Meurthe, and Cote-d'Or; in Swabia it is collected at Vaihingen, Möhringen, Bebenhausen, and Nürtingen; for the other countries in Europe in which it is found the reader is referred to the table of synonyms.

History.—First figured by SOWERBY; afterwards by ZIETEN, d'ORBIGNY, and HAUER. These figures are all good, and leave but little to be desired.

AMMONITES ROTIFORMIS, Sowerby, (Plate 3, fig. 1.)

AMMONITES ROTIFORMIS, Sowerby, Mineral Conch., vol. 5, tab. 453, 1824.

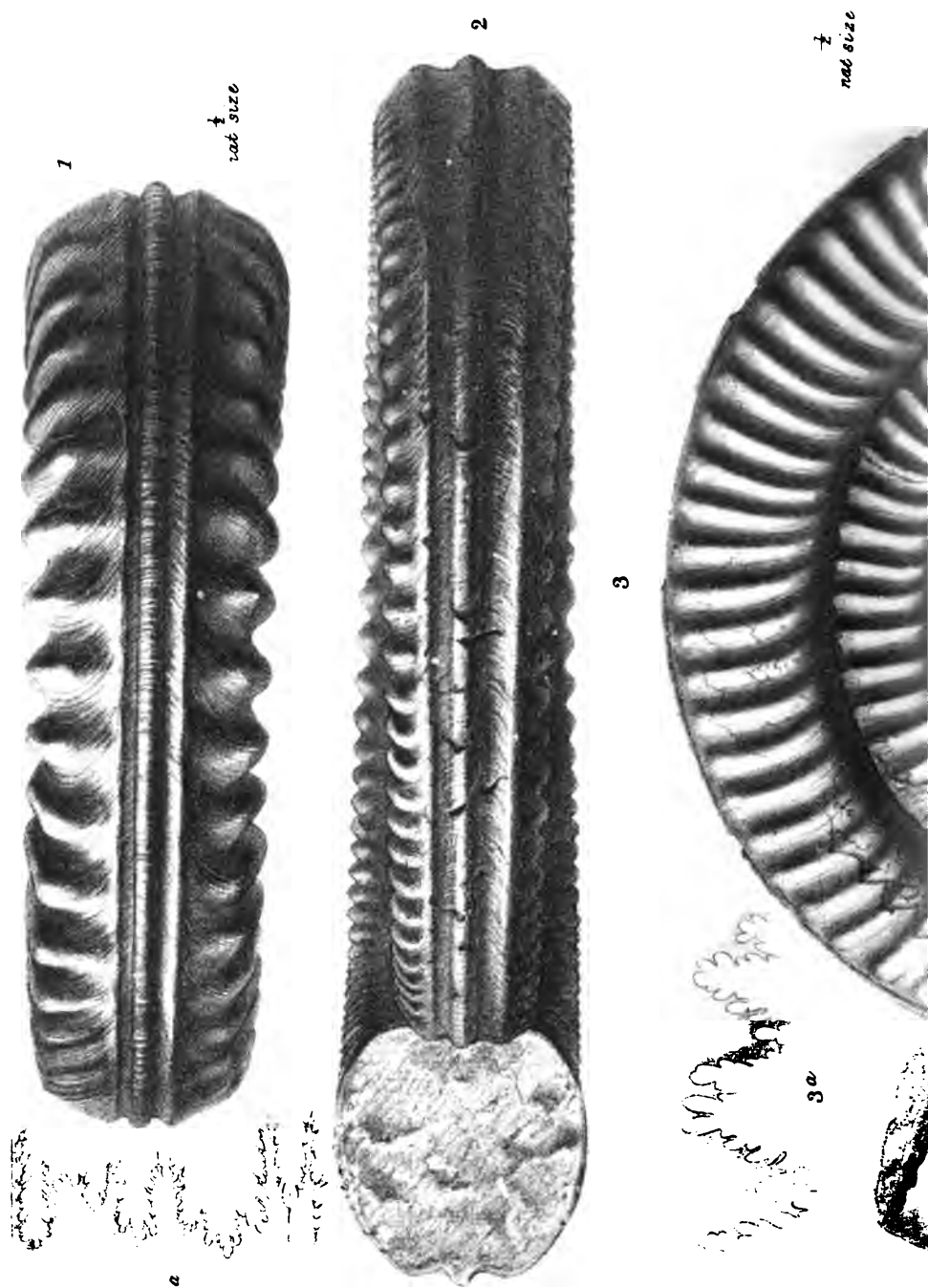
- " **OBLIQUE-COSTATUS, Zieten, die Versteinerungen Württembergs, tab. 15, fig. 1, 1830.**
- " **ROTIFORMIS, Zieten, die Versteinerungen Württembergs, tab. 26, fig. 1, 1831.**
- " **ROTIFORMIS, d'Orbigny, Paléontologie Française ter. Jurassique, plate 89, 1844.**
- " **OBLIQUE-COSTATUS, Hauer, Jahrbuch geologischen Reichsanstalt, Band 4, p. 736, 1853.**
- " **ROTIFORMIS, Studer, Geologie der Schweiz, Band 2, p. 30, 1853.**
- " **ROTIFORMIS, Hauer, die Cephalopoden aus dem Lias der Alpen, tab. 1 and 9, s. 13, 1856.**
- " **ROTIFORMIS, Quenstedt, der Jura, p. 67, tab. 7, fig. 1, 1858.**
- " **ROTIFORMIS, Oppel, die Juraformation, p. 77, 1856.**

Diagnosis.—Shell discoidal, compressed; back tricarinated; whorls numerous, quadrate, slightly involute, and strongly costated; costæ from 27 to 30 in a whorl, simple, strong, arched, and terminating near the back in a large, round, obtuse tubercle; back large, flat, with a median keel, two lateral sulci, and marginal carinæ; aperture quadrate, depressed, sinuous anteriorly.

Dimensions.—Transverse diameter, 7 inches; height of aperture, $1\frac{1}{4}$ inches; width of aperture, $1\frac{1}{4}$ inches. M. d'ORBIGNY's specimen:—width of the last whorl, $\frac{11}{16}$; portion overlapped of last whorl, $\frac{1}{16}$; thickness of last whorl, $\frac{3}{16}$; width of the umbilicus, $\frac{6}{16}$.

Description.—Shell discoidal, compressed, with quadrate whorls, strongly ribbed, and slightly involute. In the specimen I have figured,

* Proceedings of the Cotteswold Club for 1863, p. 135.





J.W. Saller del. ad nat.

1 *Ammonites rostriformis* Sow.
2 & 3 *Ammonites Conybeare* Sow.

1a Sutures from D'Orbigny.
3a Sutures from D'Orbigny.

M & N. H. Hart. imp.

(plate 3, fig. 1,) the inner whorls are partly absent, and in part concealed; in SOWERBY's type, only four whorls can be counted, the central ones being absent; in d'ORBIGNY's fine specimen, which is almost perfect, there are eight whorls, and this we may regard as the normal number in a shell 180 millimètres in diameter; the number of ribs in a whorl differ much in different specimens, thus in SOWERBY and ZIETEN's shells there are 27; in HAUER's, 34; and in d'ORBIGNY's, 45; they are simple, strong, and arched, and terminate near the back in a large, round, obtuse tubercle. SOWERBY says, "the ribs rising in knobs just as they reach the front give the whorls a very square aspect; the ribs and the hollows between them are nearly equal. The back is wide, in consequence of the extension given to this region by the size of the costal tubercles; upon the middle line of the back is a strong, thick, rounded keel, having on each side thereof a deep sulcus, bounded by lateral elevations, so that the broad back is tricarinated with two intervening sulci. The spire is composed of quadrate whorls, with prominent costæ, and a series of nodules along the curvature of the spire. The aperture is quadrate, depressed, and sinuous anteriorly.

The septæ in this species, according to M. A. d'ORBIGNY, are symmetrical, divided on each side into four lobes, of which the two external lateral are formed of unequal parts. The dorsal lobe, (plate 3, fig. 1a.) one-third longer than the superior lateral lobe, is ornamented on each side with a long denticulated branch. The dorsal saddle, one-half the width of the superior lateral lobe, formed of three divided leaves, of unequal size, of which the median is the largest. The *superior-lateral lobe* terminates by two points, and has on each side three or four others. The *lateral saddle*, narrower than the superior-lateral lobe, is formed of three unequal leaves, resembling those of the dorsal lobe. The *inferior-lateral lobe*, half the width of the superior-lateral lobe, terminates by two points. The two *auxiliary lobes* are very small, and divide into one median and two lateral points. The central ray, in parting from the extremity of the dorsal lobe, passes well below all the lobes externally visible, but reaches the extreme ventral lobe, which is bifurcated, and accompanied on each side by a very large ventral saddle."

Affinities and Differences.—This species resembles in many characters *A. Conybeari*. It is distinguished, however, from that form, by having a wider back, fewer ribs, and each terminating in a large obtuse tubercle; the septæ are likewise much more complicated than those of *A. Conybeari*. It resembles *A. Bisulcatus*, Brug., in possessing simple ribs with dorsal tubercles, and two deep sulci on each side of the median keel. It is

distinguished from that form in having narrower whorls, a larger umbilicus, and very different septæ: compare, for example, the sutures in plate 3, fig. 1, with those in plate 4, fig. 2a.

Locality and Stratigraphical Position.—This is a very rare Ammonite; my specimen was collected from the Lower Lias, near Lyme Regis, its precise horizon I could not ascertain; SOWERBY's specimen was found in the Lias, near Yeovil; I have seen fragments from a railway cutting through the Lower Lias of Somerset.

Foreign Localities.—M. d'ORBIGNY collected it from the Lower Lias, with *Gryphaea arcuata*, at Ponilly, Côte d'Or, where it is rare. Professor QUENSTEDT says it is most abundant in Germany, and is collected at Vaihingen, Möhringen, Gmünd. Professor HAUER's figured specimen was collected in the Yellow Kössener beds at Enzesfeld, near Vienna. Professor STUDER found it in the Lower Lias of the Berner Alps; and LARDY at Coalat and Fondement, near Bex.

AMMONITES BISULCATUS, *Bruguière*, (Plate 4, fig. 2 a, b, c)

Rob. Plot's Natural History of Oxfordshire, tab. 5, fig. 14, p. 110, 1677.

Martin Lister, *Historia Angliæ, de Lapidibus Turbinatis*, tab. 6, fig. 3, p. 207, 1678.

AMMONITES BISULCATA, *Bruguières*, (pars) *Encyclopèd. Method.*, tom. 1, p. 39, No. 13, 1789.

" MULTICOSTATA, *Sowerby*, *Mineral Conchology*, tab. 454, 1824.

" MULTICOSTATA, *Zieten*, *Versteinerungen Würtembergs*, tab. 26, fig. 3, 1830.

" BISULCATUS, *d'Orb.*, *Paléontologie Fran.*, pl. 43, p. 187, 1842.

" MULTICOSTATUS, *Quenstedt*, *die Cephalopoden*, p. 80, 1849.

" MULTICOSTATUS, *Quenstedt*, *Handbuch der Petrefactenkunde*, p. 355, 1852.

" BISULCATUS, *Hauer*, *die Cephalopoden aus dem Lias*, pl. 1, fig. 3, p. 14, 1856.

" BISULCATUS, *Oppel*, *die Juraformation*, p. 77, 1856.

" MULTICOSTATUS, *Quenstedt*, *der Jura*, p. 67, tab. 7, fig. 2, 1858.

Diagnosis.—Shell, depressed, discoidal; back, tricarinated; whorls, subquadrate, with 30 to 40 strong, sharp, bent ribs, having a tubercle near the dorsal margin of each; median keel, strong, with two sulci and two lateral carinæ; aperture, subquadrate, bisinuated anteriorly; lateral septa with three lobes.

Dimensions.—Transverse diameter, 8 inches; height of aperture, 2½ inches: width of aperture, 2½ inches.

Description.—The table of synonyms prefixed to this article is very limited when compared with the lists given in the works of M. d'ORBIGNY and Professor HAUER; it is due, therefore, to the reader and myself that I should give my reasons for excluding many of the citations of my contemporaries. In my description of *Ammonites Bucklandi*, Sow.,* I have stated that M. BRUGUIERE, in the *Encyclopédie Methodique*, tom. 1, p. 39, described, under the name of *Ammonites bisulcata*, two distinct forms.—(A.) *Ammonites Bucklandi*, Sow., and (B.) *Ammonites multicostata*, Sow. These two forms were thus described:—

A.—“*Ammonites costis simplicibus raris, dorso bisulcato, carina acuta intermedia.*”

B.—“*Ammonis cornu spina in ambitu eminente, striis lateralibus, ex toto orbem extimum trajicientibus.*”

The variety A. had been previously figured by MARTIN LISTER in his *Conchyl. Angliæ*, p. 207, tab. 6, fig. 3, and by LANG in his *Historia Lapidum Figuratorum Helvetiæ*, tab. 24, fig. 1, and there described as “*Ammonis cornu striatum vulde striis integris elatis in spinam inter duos sulcos eminentum abeuntibus.*” The variety B. had been included in BRUGUIERE's general diagnosis of *Ammonites bisulcata*, and most authors have followed BRUGUIERE in grouping both forms under one specific name. I am inclined however, to think that Sowerby was right when he figured both forms under distinct names, as M. d'ORBIGNY and Professor HAUER, in their works already cited, have figured good type forms of *A. multicostata*, Sow. I assume that this is the recognized type of BRUGUIERE's *A. bisulcata* in France and Germany, whereas the true *A. Bucklandi*, Sow., is seldom figured in any work on Lower Lias fossils. I have, therefore, determined to retain BRUGUIERE's name for his var. B., and SOWERBY's name for var. A. In accordance with this view I have excluded all references to the synonyms of authors, unless I had a figure or a specimen for my guide, to determine the form referred to in the citation; this mode of proceeding has necessarily diminished my list, but makes it more correct for reference. *Ammonites bisulcatus* has a depressed discoidal shell, with a strongly tricarinated back, and subquadrate whorls. The sides are provided with 30 to 40 simple, narrow, slightly bent ribs, each terminating in a blunt tubercle, near the dorsal border. From the tubercle the rib bends sharply forwards, and disappears at the outer carinæ. The back is flat and tricarinated, the median keel a little more prominent than the laterals, and the two sulci, although well marked, are not very deep in my specimens; the lateral carinæ are well defined; the shell is bevelled

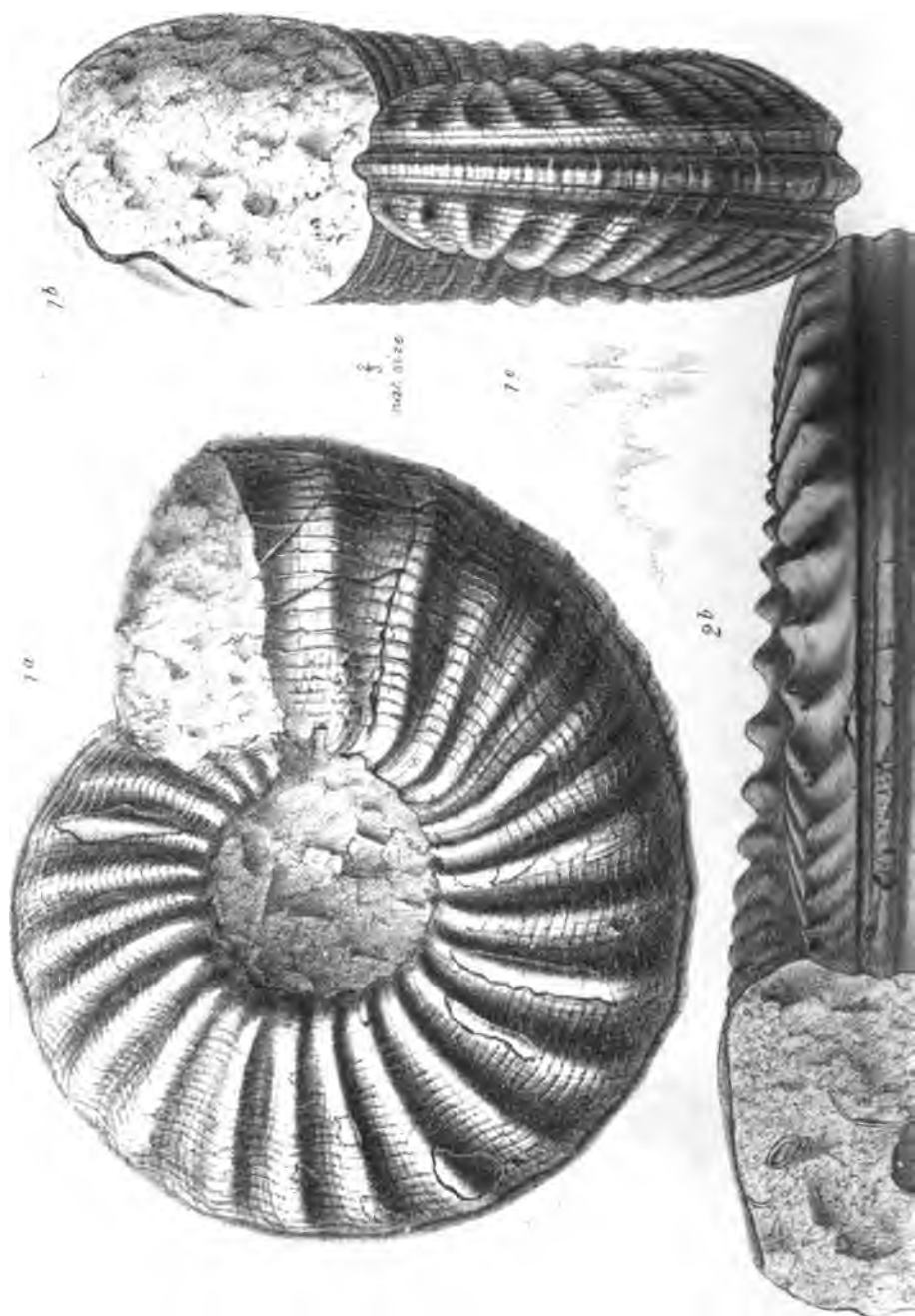
* Proceedings of the Cotteswold Naturalists' Club for 1863, p. 173.

off from the ridge to the row of tubercles, and presents a series of oblique undulations occasioned by the vanishing of the ribs. The spire is composed of subquadrate whorls: in a specimen, $5\frac{1}{2}$ inches in diameter, there are six whorls visible; on the outer whorl are 37 ribs; on the second, 30; on the 3rd, 29; on the third, 29; so that in this example the number of the ribs increases with the number of the whorls. The aperture is quadrate, rather higher than wide, a little enlarged at the spire, and sinuous above where it is marked by the central keel, the sulci, and lateral carinæ. (Pl. 4, fig. 2 b.)

The septæ are symmetrical, foliated on each side, and divided into three lobes, and three saddles formed of unequal parts, fig 2 c. *Dorsal lobe*, narrow, one-third longer and a little wider than the superior-lateral lobe, having on each side five slightly unequal digitations. *Dorsal saddle*, one-fourth wider than the superior-lateral lobe, and divided into three unequal parts by two unequal accessory lobes. *Superior-lateral lobe*, a little longer than wide, has three foliated branches on each side. *Lateral saddle*, nearly double the width of the superior-lateral lobe, divided into many unequal lobes. *Inferior-lateral lobe*, nearly as wide as the superior-lateral, and divided into numerous unequal digitations. *Auxiliary saddle*, half the size of the superior-lateral lobe, divided into several unequal folioles. *Auxiliary lobe*, narrow, descending much lower than the others, and formed of two branches, the one external, and the other inferior. The line of the central ray passing by the dorsal lobe cuts the superior-lateral lobe.

Affinities and Differences.—This Ammonite strongly resembles *A. Bucklandi*, Sow.; it is distinguished, however, by having the whorls more quadrate, and the general form being more angular; the 34 to 36 ribs, have each a tubercle near the dorsal border, from whence they curve sharply forwards towards the sulcus. In *A. Bucklandi* there are about 24 ribs, which gradually disappear on the dorsal border, and there are no tubercles near the angle of the sulcus. It is distinguished from *A. obtusus*, to which it has a general resemblance, by having narrower whorls, tuberculated ribs, and a flatter back.

Locality and Stratigraphical Position.—This species has been found in the Zone of *Ammonites Bucklandi*, (Lower Lias,) near Lyme Regis and Charmouth, on the coast of Dorset; near Bath; in the deep cuttings of the Bristol and Birmingham railway, near Defford, Bredon, Cheltenham, and Gloucester; and in other localities in the Vale of Gloucester, as by Coombe Hill, Highnam, and Berkeley. The Warwick Museum contains



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some fine specimens from the Lima beds of the Lower Lias of Warwickshire; and my friend JOHN LECKENBY, Esq., F.G.S., has several fine shells of this species collected from the Lower Lias at Robin Hood's Bay, on the coast of Yorkshire.

Foreign Localities.—Germany,—in Swabia, according to Professor OPPEL, it is abundant in the Bucklandi beds of Bodelhausen, Vaihingen, Möringen, and Gmünd, and in France from the same zone in the vicinity of Metz, (Moselle,) and Avallon, (Yonne.)

History.—The history of this species is curious and instructive: towards the end of the 17th century it was figured by PLOT and LISTER in this country, and by LANG and BOURGUET on the continent. In 1787, it was first correctly described in the *Encyclopédie Methodique* by M. BRUGUIERE as *A. bisulcata*, he recognized two distinct varieties of the species, one with few ribs, without tubercles; the other with numerous ribs having a tubercle on each. SOWERBY, in his *Mineral Conchology*, in 1818, figured the former as *A. Bucklandi*; the latter, in 1824, as *Ammonites multicostata*. Unfortunately this author entirely overlooked the excellent work previously done on Ammonites by M. BRUGUIERE. In 1830, ZIETEN figured as *A. multicostata* a good type specimen from the Lias Limestone of Altingen, near Tuttlingen, so that BRUGUIERE's specific name was nearly forgotten, when M. A. d'ORBIGNY, in his *Paléontologie Française*, in 1844, gave a historical account of this species; d'ORBIGNY, however confused *A. Bucklandi*, Sow., with *A. bisulcatus*, Brug., an error which I have endeavoured to rectify in my description of these two forms.

AMMONITES OBTUSUS, *Sowerby*. (Pl. 4, fig. 1, a, b, c.)

AMMONITES OBTUSUS, *Sowerby*, *Mineral Conchology*, vol. 2, tab. 167, p. 151, 1817.

" SMITHII, *Sowerby*, *Mineral Conchology*, vol. 4, tab. 406, p. 148, 1823.

" OBTUSUS, *Phillips*, *Geology of Yorkshire*, p. 164, 1829.

" OBTUSUS, *d'Orbigny*, *Paléontologie Française* ter. Jurassique, pl. 44, p. 191, 1842.

" OBTUSUS, *Chapuis de Devalque*, *Fossiles de Luxembourg*, pl. 4, fig. 3; pl. 5, fig. 1; p. 39, 1853.

" TURNERI, *Quenstedt*, *Cephalopoden*, tab. 3, fig. 19, p. 77, 1846.

Shell compressed; back carinated, carinæ obtuse; aperture rotund-compressed, bisinuated above; whorls subrotund with lateral ribs; costæ, 25

to 30, obtuse, vanishing near the carinal sulci; lateral septæ 3 lobed; shell covered on the back and sides with fine longitudinal lines, 28 on each side of the whorl, producing a series of punctuations where they intersect the transverse lines of growth.

Dimensions.—The usual size is from 6 to 8 inches in diameter, but it attains 12 to 14 inches. The relative dimensions calculated from several specimens are—height of the last whorl, $\frac{4}{10}$; width, $\frac{1}{10}$; width of the umbilicus, $\frac{4}{10}$; involution of the whorl, $\frac{2}{10}$ of the diameter of the shell.

Description.—This Ammonite has a discoidal shell, moderately compressed on the sides, but more so towards the back, which is furnished with a very thick obtuse keel, having on each side a deep sulcus separating it from the two lateral carinæ formed by the angles of the sides and back; mouth compressed, bisinuated at the summit, and strongly grooved by the turn of the spire; whorls slightly compressed in the middle, and more so towards the upper third; provided with from 25 to 30 moderately prominent acute ribs, which are arched, and disappear at the angle of the back before they merge into the lateral carinal sulci; the valleys between the ribs are very regularly concave.

The entire surface of the shell is traversed by fine longitudinal lines, as if they had been cut by a graver; on the specimen before me there are sixty-six such lines on the back and sides of the whorl, and at the point where they intersect the transverse lines of growth a punctuated depression is produced, which imparts an ornamental character to the shell of this species.

The septæ are symmetrical, divided on each side into four lobes and four saddles, formed of unequal parts. The *dorsal lobe* is long and wide, and divided on the median line one-third of its length, presenting numerous small equal-sized digitations around its circumference; the *dorsal saddle* as large as the dorsal lobe, has shallow ramifications on its outer side, and three small festoons on its anterior border; the *superior lateral lobe* is conical, and about two-thirds the length of the dorsal lobe; the *superior saddle* is larger than the dorsal saddle, and presents some better developed simple festoons on its border than those on the latter; the *inferior lateral lobe* is about as large as the superior, and presents numerous small rounded digitations on its circumference; the *auxiliary saddle* is about one-fourth the size of the dorsal, and has a similar form; the *auxiliary lobe* is nearly as large as the infero-lateral.

Affinities and Differences.—This species very much resembles *Ammonites stellaris*, Sow.; so much so, that the one is often mistaken for the other. Both have longitudinal lines on the shell, and punctuations at

the points of intersection of these with the lines of growth; in *A. stellaris* the shell is more compressed, the keel smaller and not so obtuse; the digitations of the lobes are likewise more complicated, and the saddles longer and narrower.

Locality and Stratigraphical Position.—This Ammonite characterises a well marked zone of life in the Lower Lias, which was well shown at Bredon during the cutting of the Bristol and Birmingham Railway, and from whence I obtained all my best specimens. The rock consisted of dark-gray bluish shales and marls, with irregular and inconstant bands of limestone. This Ammonite is found near Statford-on-Avon, in Warwickshire; it is collected in great abundance between Lyme Regis and Charmouth, where the shells are replaced and their septæ filled with crystallised carbonate of lime. These beautiful fossils are called "Tortoise Ammonites" by the local collectors. The young examples of this species found with *A. planicosta*, Sow., in the Marston marble of Somersetshire, which belongs to the zone of *A. obtusus*, have been figured by SOWERBY under the name of *A. Smithii*.

In Robin Hood's Bay, on the Yorkshire coast, I have found this species, which, however, is very rare in that county, *A. stellaris* being here the dominant form, and called *A. obtusus* in most of the public and private collections.

On the continent of Europe it has been found in France, in the environs of Saint-Ramber, (Ain,) and in the province of Luxemburg, at Ette. It is found in South Germany in many localities. Professor QUENSTEDT mistook this species for *A. Turneri*, Sow., and figured it as such; the Professor, however, recognised the stratigraphical importance of this form, as he found it characteristic of a zone, which he called "*Turnerithone*." It is found at Balingen, Oster-dingen, Betzingen, and Betzgenreith.

*Address to the Cotteswold Naturalists' Field Club. Read by the President,
W. V. GUISE, Esq., F.L.S., F.G.S., at the Annual Meeting, held at
the Bell Hotel, Gloucester, on Wednesday, 29th March, 1865.*

GENTLEMEN,—

The return of another season calls us again together, to renew, as I hope, the happy associations of former years, in pleasant rambles a-field, in the exchange of congenial thought, in friendly greeting and intercourse, and in the enjoyment of that spirit of good fellowship which gives a zest to our pursuits, and clothes the sober aspect of philosophy in a "light and joyous livery."

There is little in the present condition of the Club which calls for any special remarks from me. Our number of contributing members, 86, is somewhat under our full complement, a deficiency which will, as I believe, be shortly made good by the expected addition of fourteen new members. The fasciculus of our proceedings is a very good one, and shews no falling off in the number or value of the papers contributed. This will complete the third volume of our Transactions.

At the meeting which took place in the Forest of Dean, a strong desire was expressed that the Section of Drybrook, made by Mr. JONES and our Secretary, Mr. LUCY, should be published. The proposal attracted some attention at the time, and application has since been made for the section by the Secretary of the Severn Valley Field Club. It seems very proper that this design should be carried out, but its execution during the current year must, I fear, be deferred, as our funds are not at present in condition to bear the expense. This, again, brings me to the point to which I drew your attention last year, of the insufficiency of our subscriptions to meet the expenses of the Club. Hitherto, by careful management, we have kept out of debt. This year, however, we are threatened with a deficiency, not large it is true, but such as constrains us to economise our outlay, and in so far to starve our work. It is my intention, therefore, to propose that our subscriptions be advanced to £1. annually in lieu of 10s., which will amply suffice to provide for the due publication and illustration of the important monographs and other scientific papers of value, which need more space for their due expansion than we are now in position to afford.

It is with a sense of real regret that I have to announce to the Club the desire expressed by Mr. LUCY to retire from the office, which for the past three years he has discharged so eminently to our advantage as the Honorary Secretary of the Club, the duties connected wherewith have become more burthensome upon his time than his leisure would permit. Personally I feel under the greatest obligation to him for his assistance and support, which have rendered my labours light indeed. By the Club generally, his retirement will be felt as a loss well nigh irreparable. Where amongst us can we find one endowed with so many fitting qualifications for the post?—presenting, as he does, a rare union of tact, discretion, and gentlemanly courtesy, combined with a catholic love and competent knowledge of Natural Science; and habits of method and order which he has brought to bear with such admirable results upon the business of the Club. Mr. LUCY has kindly consented to discharge, temporarily, the duties of Secretary pending the appointment of his successor, to whom he tenders his valuable advice and assistance. In the meantime, I desire to commend the selection of a gentleman to fill the vacant post, to the careful consideration of the Club, whose interests are vitally concerned in the appointment.

I proceed now to give an account of the proceedings at the different field-meets held during the past season.

The annual meeting of the Club took place on Wednesday, 9th March, at the Queen's Hotel, Cheltenham, at which the usual business was transacted, the accounts audited and passed, and the officers for the ensuing year elected, when you were pleased to testify your confidence in myself and Mr. LUCY by again choosing us to fill the posts of President and Secretary respectively.

The very unfavorable condition of the weather prevented any distant excursion; but in spite of the snow, which fell without intermission during the afternoon, several members of the Club visited the newly-established library in Clarence Street, in which an assemblage of 4,000 volumes of well-selected works in science and general literature does infinite credit to the energy of our colleague, Major BARNARD, by whose active agency this useful establishment has been organised and arranged.

The members dined together at the Queen's Hotel. After dinner the President read his annual address. An interesting paper was then read by Mr. WITCHELL upon the very remarkable deposit containing worked flints and other evidences of man's presence, which were found associated with land and freshwater shells in the excavations for a reservoir on the summit of a hill above Stroud, in a bed which has now obtained notoriety

through the published views of our colleague, Mr. JOHN JONES; who was the first to draw attention to the phenomena there presented in a very learned paper, which appears in our Transactions for the year 1863. In that paper, Mr. JONES—basing his views upon a careful consideration of existing conditions—suggests the possibility that the ancient people, whose works were there brought to light, might have existed upon that spot previous to the formation of the Stroud valley. Mr. WITCHELL's paper is directed mainly to the effect of land-slips on the spot, and in the immediate neighbourhood, to which agency he is disposed to attribute the phenomena of the beds in question. The subject is, however, still open to further investigation, which, as its importance justifies, it will doubtless receive at the hands of the Cotteswold Club.

The reading of the President's address, brought again under discussion the circumstances connected with the opening of the Foxcote "tumulus," which, upon a former occasion, aroused the susceptibilities of some of the antiquaries concerned; who, to confess the truth, did not seem to be quite in accord respecting the facts of "the find." This gave occasion to much waggery and good-humoured banter, which found expression, at length, in the following humorous lines from the pen of our colleague, Mr. D. NASH, which I here proceed to embalm in the records of the Club.

THE DOCTOR AND THE PARISH CLERK.

THE FOXCOTE FIND.

"Well, neighbour, if you axes I to tell you what I found
In the tump at Foxcote yonder, in the fourteen acre ground,
If you'll stand a drop of summat, for talking makes me dry,
I'll tell you what I knows on it, and the gospel truth thereby.
Not what I told them chaps as come up here from Cheltenham town
A axing lots of questions, and a writing of it down:
'A doctor' and 'a parson,' and another gent I knows,
Leastways I knows his father, as I've reason to suppose,
For he given me seven days in quod, for nothing as you may say,
Only being drunk of a Saturday night, and 'saulting pleeseman Day.*
Well, you knows the fourteen acre ground, and the tump as used to
be there,
'Twas nout but a heap of stones as was throwed promiscuous-like in
the air,
For I minds when the field was first ploughed up, and how we gathered
the stones.
So when they comes a axing I if I'd found in it any old bones,

* Sergeant Day, a well-known, active officer of the Cheltenham police force. This is a convincing proof of the truthful character and minute accuracy of the whole statement.—*Note by P. P., Parish Clerk.*

Or kwines† or brass fardens, or such like, or anything out of the way,
 I were stummed like just at first, and were just a going to say
 I hadn't found nothing at all, when I thought of a bit of a lie ;
 So I told 'em I'd got all they ax'd for, and had putten 'em carefully by,
 To home in my cottage at Foxcote, and if they'd come up the next day,
 I'd show 'em the bones and the kwines, and tell 'em exact where they
 lay.

So I gets me a lot of old kwines that the childer has oftentimes found,
 And the plough will turn up by the score when they breaks up a piece
 of new ground,

And some half-a-score of old bones as I got for a pint of beer
 From old Joe Smithers, the sexton, down by the churchyard here ;
 And a piece of a broken pot as I'd throw'd at my misus's head,
 When she were a aggrawating about the drink, as she said ;
 And I puts 'em out in the garden, and covers 'em up from the rain,
 And waits till these 'ere gents should be looking in again.
 The first as come was 'the doctor,' and he looked so mortal wise,
 Thinks I he is sure to find out as I'm telling on him lies ;
 But Lord ! when he seed the bones he took to 'em just as kind
 As they'd been his own grandfather's as he'd known time out of mind ;
 And he said 'twere a hancient Briton as somebody had drew'd,‡
 And after they'd taken his pictur the Romans had had him slew'd.
 But I know'd better than that, for old Joe Smithers said
 Them bones was the bones of a woman as hadn't died in her bed,
 For she'd been crossed in love, and drowneded herself in a pond,
 And that's why she werd'n't buried in cussicrated ground.
 Then I gives the kwines to the parson and tells him how they was lain
 Along with the bones in the tump, as he said they ought to ha' been ;
 And I gave the young'un the pot, which I didn't say nothing about,
 For he looked so grumpy and sly, I were fear'd he ha' found me out.
 So they gives me a crown apiece, and I thanks 'em for favours past,
 And I drinks to their healths, and hopes as this'un won't be the last,
 For I knows of another field with a main big tump of stones,
 But I says nothing on it as yet, for I havn't got no more bonea."

† *Kwines* for *coins*.—Our friend's orthography is a little uncertain.

‡ My worthy neighbour has evidently misunderstood the observation of the learned doctor. The latter knowing that a skeleton found in a tump must be that of a Druid, the high priest of a pagan and idolatrous superstition formerly prevailing in our now enlightened land, at once pronounced that the bones exhibited to him were what they ought to have been, which is the same thing as if they had been so.
 —P. P., Clerk of the Parish.

Wednesday, 25th May. The Club met at Stroud, and proceeded under the guidance of Mr. E. WITCHELL to Rodboro' Hill, to examine certain shallow depressions in the soil, with contiguous tumps of earth very numerous in the upper surface and slope of the hill, and supposed to be referrible to the hut-dwellings of the earliest inhabitants. These had attracted the attention of Mr. WITCHELL, whose researches had been

rewarded by finding some pieces of Roman pottery. Two of these "pit-and-tump" excavations were opened by the Club, but without result beyond finding stones which bore marks of fire upon their surface. The probability is, that these depressions were used as temporary cooking-places, the earth being thrown up to windward, after a fashion that is still prevalent among the natives of Hindostan. The presence of long lines of earthwork still plainly shew that the hill was at one time strongly fortified, and the cooking-places may well have been the work of camp-followers, probably of the period of the Roman occupation, from the character of the pottery.

From Rodboro' the party visited the quarries at Minchinhampton, so fully described by Dr. LYCETT in his work on the "Cotswold Hills."

After descending the valley to Woodchester, several sections were examined in the railway-cuttings of the Nailsworth line, now in course of construction.

The Secretary read a letter from Mr. JOHN JONES, in illustration of an accompanying specimen of *Fusus vesiculosus*, which by its expansion under heat had torn assunder during very low tide, a small piece of compact stone on which it grew. Mr. JONES says, "It is readily conceivable that in warm climates where the rise and fall of the tide is considerable, similar operations may take place upon an extensive scale. The decomposition of rocks by vegetation of a low character is, of course, well known, but the present instance serves to illustrate the action of a disintegrating force, the existence of which is probably little known."

The Secretary likewise read a paper by Mr. JONES, in amplification of Sir CHARLES LYELL's First Chapter on the "Antiquity of Man," concluding as follows:—

- "1. That the great changes in the characteristic vegetation of the districts referred to, have been effected solely by modifications of temperature, in great part produced by telluric oscillations.
 - "2. That the laws regulating the periodical prevalence of certain forms of vegetable life have been uniform in their operation at all times.
 - "3. That the zones of vegetation above recognized, have always maintained relations toward each other similar in kind to those which now exist between them, and that on this supposition the difference of climate which characterized the periods indicated respectively by the prevalence of fir, oak, and beech, may be roughly estimated from the difference between the number of degrees of latitude which form the limits of the northern range of each, which appears to be about four in each instance.
- "And lastly, That the lapse of time required for the changes traced, and the natural operations involved in effecting them, far surpassed in duration the scope of our most extended chronologies."

On Friday, 24th June, the Club met at Mitcheldean, and breakfasted at the George Inn. After breakfast the members visited the fine old Church, which has recently been carefully restored. From thence the party passed along the new road, examining by the way the succession of sandstones, limestones, and "mine" measures, and the curious old mining places, called "Scowles," from a British word signifying "hiding-places." Some of these are of great extent and depth; they have been worked by ancient miners as far as the water would permit. These "Scowles" have been formed by the excavation in the Mountain Limestone of certain cavities filled with iron ore, called by the miners "Pouches" and "Churns."

Our colleague, Dr. BIRD, in the paper on the "Forest of Dean," read to the Club at this meeting, has some interesting information on the subject of these "Scowles," respecting which, and all matters connected with Forest history, his long residence in that district and his intimate acquaintance with its peculiarities, especially fit him to be its chronicler. He states, "In conversing with a person some years ago on the means employed by the 'old men' to procure the mine from these cavities, and to follow it through the narrow crevices in the hard rock to the water-level: he gave it as his belief, that when the cavities contracted so much as to prevent them from getting at the mine, they were in the habit of lighting strong charcoal or wood fires until they had burned the limestone rock into lime, which they slaked and removed, and thus opened a way from one cavity to another, so as to enable them to follow the mine—that there are clear traces in many of the old 'Scowles' of the employment of such a plan for removing the rock—that it was efficient, but much more tedious than that of blasting with gunpowder."

The party proceeded by Wig Pool to the cutting on the Ross road, and thence by Drybrook, Nailridge, and across the Forest to the Speech House. At Drybrook the elaborate and careful section of Messrs. Jones and Lucy was examined throughout, and compared layer by layer, with the original, and found scrupulously correct. I have already directed attention to the propriety of publishing this work, as soon as our funds will permit.

The members dined together at the Speech House, after which a paper on the "Forest of Dean" was read by Dr. BIRD.

On Thursday, 21st July, the Cotteswold, Malvern, and Woolhope Clubs met at Ross. The programme for the day embraced a boat voyage down the Wye, and a walk by English Bicknor and Symond's Yat to Whitchurch, returning thence, by carriages, to Ross. The Club mustered for breakfast at the Royal Hotel in great force—the numbers somewhat inconveniently

swollen by an influx of visitors of both sexes—whom the beauty of the weather and scenery drew together in numbers which threatened to disconcert all the arrangements of the secretary, and to convert the meeting into a pic-nic. It would be well, in order to prevent disappointment in future, that ladies and gentlemen should recognise the fact, that there is necessarily a limit to the admission of visitors to the Field Club Meetings, especially in those cases where more Field Clubs than one come together, when the accommodation required for the members taxes all the energies of the executive to provide for it, without the further embarrassment caused by a large influx from without. Happily, in this instance, the foresight and tact of our Secretary, Mr. LUCY, were equal to the requirements of the occasion; and so complete were the arrangements for the transport and supply of such a large party, that no hindrance or difficulty occurred.

After breakfast, a move was made to the boats, into which admission was gained by means of tickets issued by the Secretary—a preliminary which necessarily occasioned some delay. At length the flotilla got under way, the President's barge leading, and in gallant array the boats swept down the first bend of the river, and under the arch of the bridge at Wilton. But here an unforeseen obstacle brought the whole to a standstill—the first of a series of a like nature, which at one time threatened to bring the voyage to a sudden and unexpected termination. The water, owing to the long drought, was lower than the boatmen "had ever know'd it," and, on the shallows below the bridge, the President's barge came to grief, taking the ground with a dull grating sound, and remaining there, firmly fixed, in spite of all efforts. The next boat, bearing the President of the Malverns, followed suit, and in a few seconds the whole flotilla was "hard and fast,"—poling, shoving, swaying,—while the entire population on the banks turned out to see the fun. The delay here was very considerable; and though the boatmen exerted themselves to the utmost,—toiling bare-legged in the water—nearly half-an-hour elapsed before the boats were again afloat.

A mile above Goodrich all the passengers were landed, there being a long reach of the river too shallow to admit of passage by laden boats. This afforded an opportunity of visiting the castle, which was availed of by many. Again re-embarking, the party proceeded down the river, enjoying the richly-varied scenery which the windings of its course displayed, until, in due time, they arrived at Lydbrook, where, in a small hostelry hard by, the discovery of good bread, cheese, and beer, brought

refreshment to the wayfarers, and much profit, it is to be hoped, to the landlady.

At this point the boat voyage terminated ; and in a hot sun, by dusty ways, a long string of pedestrians struggled up the hill that leads to English Bicknor ; but ere they had reached the summit, a very unlooked for, and under the circumstances, a very unwelcome, change in the atmosphere took place,—it began to rain, and, by the time that the party had gained the shelter of the church at English Bicknor, the rain fell heavily.

The church, which still retains traces of Norman work, sufficient to render it of interest to the antiquary, was examined with much attention. The clergyman, Mr. BURDON, affording every facility to the visitors, and personally inviting attention to the points most worthy of notice.

Time, however, would not permit of much delay ; and in a steady down-pour of rain the excursionists proceeded on their way, which led them by a romantic path through the Forest, commanding from above most extensive prospects of rock and wood, with the beautiful Wye winding far below. These glories culminated at Symond's Yat, where, however, the continued rain forbade a long delay, and all hurried down to the ferry below, by which the further bank of the river was gained, and a mile or two further, Whitchurch, where the foresight of the Secretary had established an ample supply of vehicles for the transport of the party to Ross.

What boots it to tell in what draggled trim the passengers arrived?—and how those who, like Gehazi, had taken the precaution to secure “two changes of raiment,” rejoiced greatly in their forethought ; while others less provident had to go to bed instead of to dinner. Suffice it to say, that in due time all the party came together, some eighty sitting down to table, and doing ample justice to the good things provided for their entertainment by the hostess of the Royal Hotel.

After dinner, the Rev. W. S. SYMONDS read a short notice of the geology of the district around Ross, which the state of the weather had prevented his delivering in the field.

Dr. BIRD read a paper on the round and long tumuli of the Cotteswold Hills, on the character of the Roman remains and the beautiful flint implements found in these tumuli.

The following list of plants noticed in the course of the day's excursion was supplied by Dr. BULL of Hereford.

<i>Ranunculus fluitans</i>	<i>Thalictrum flavum</i>
<i>Galium mollugo</i>	<i>Hyoscyamus niger</i>
<i>Lysimachia vulgaris</i>	<i>Achillea ptarmica</i>
<i>Saponaria officinalis</i>	<i>Nasturtium sylvestre</i>
<i>Verbascum virgatum</i>	<i>Valeriana officinalis</i>
<i>Campanula latifolia</i>	<i>Lythrum salicaria</i>
<i>Epilobium hirsutum</i> and <i>roseum</i>	<i>Chlora perfoliata</i>
<i>Cynoglossum sylvaticum</i>	<i>Molinia cœrulea</i>
<i>Butomus umbellatus</i>	<i>Tilia Europæa</i> and <i>grandiflora</i>
<i>Hypericum pulchrum</i> and <i>dubium</i>	

Epilobium salicifolium, a wanderer, was also gathered, and grows in places in the district. *Rhamnus catharticus* grows in a wood near, not visited. *Tilia purvifolia*, an unusually fine specimen, grows in a lane, near Whitchurch, leading to the ferry.

Wednesday, 17th August. The members of the Club met at the Queen's Hotel, Cheltenham, where they were joined by the President, Secretary, and many of the Malvern Club; a joint meeting of Field Clubs having been arranged for the occasion, comprising besides the Malvern Club, those of "Dudley" and "the Midland:" the two latter, however, owing to local impediments, failed to keep tryst. Between 30 and 40, however, took the field under the geological guidance of Mr. ETHERIDGE, of the Geological Survey, whose beautiful sections of the Jurassic series in different parts of England, afforded a most instructive opportunity of comparing the Oolitic system elsewhere, with the typical development thereof in the now classical Leckhampton Section, towards which point the excursion of the day tended. An omnibus and four horses conveyed the party to the Seven Springs, which, as one of the fountain-heads of the Thames, is regarded with much local reverence; while in summer time an Egeria is never wanting to dispense its limpid and ice-cold waters to the thirsty wayfarer—for a consideration—which custom of the place was, on the occasion referred to, duly observed.

At Leckhampton Hill the section was thoroughly examined, and debated with reference more particularly to the correlation of its beds with the same series elsewhere, when a slight difference of opinion between Dr. HOLL and Mr. ETHERIDGE gave point and interest to the discussion. The day was remarkably fine, and the prospect from this well-known point was never seen to greater advantage.

The party dined together at the Queen's Hotel. After dinner Mr. BEACH read an instructive and interesting paper upon the Fungi of the

neighbourhood, dwelling more particularly upon those kinds which are best adapted for food. His remarks were illustrated by drawings most carefully and characteristically executed. Your President, who has closely studied this class of organisms, urged upon all the importance of cultivating a more extended knowledge of the Species of Fungi, which, irrespective of their great beauty, variety, and interest as objects of investigation by the botanist, offer with lavish bounty an abundance of good and wholesome food, which only requires to be known to secure the highest appreciation, not merely of the gastronome or experimentalist, but of the cottager and his family, who may, from these countless stores, secure many a savoury and nutritious addition to their frequently hard and unpalatable fare. These things are better understood on the Continent of Europe, where the peasantry are accustomed to preserve Fungi in oil or pickle for culinary purposes ; and death from poisoning by these vegetables is rarely known to occur.

Dr. BIRD read a paper on the Mammalian drifts opened up by the railway-cutting at Beckford, in the Vale of Evesham, which paper was illustrated by sections and drawings made by Mr. PARKINSON, C.E., and by a collection of teeth and bones of the Mammoth, Rhinoceros, Horse, Ox, &c. I would strongly advise a visit by the Club to these gravels, a thorough investigation of which, with especial reference to their derivation, bedding, and contents, would afford matter for a very valuable report. The history of these drifts has yet to be written, and will form, when completed, a most important contribution to our knowledge of a very obscure subject, to which recent discoveries have given more than ordinary point and interest. I may add, that in a visit paid to Beckford, last summer, in company with our colleague, the Rev. Mr. SYMONDS, I obtained from the gravel a portion of shell, which was identified by Mr. GWYNNE JEFFERIES as *Lucina borealis*; as its name indicates, a truly boreal type, bearing reference to the period when the glacial conditions which had at one time prevailed, were passing off.

At the request of the President, Mr. ETHERIDGE gave a sketch of the Geology of the district, as a further illustration of the practical field-work done by the Club in the morning. He exhibited a fine diagram of the "New Red Lias," "Oolitic," and "Chalk" formations, with their characteristic Ammonites, Testacea, and fossil organisms, and explained the causes of many geological phenomena connected with the thinning-out of the strata. He also shewed the physical changes in the structure and lithological character of the same rock in different localities, and

dwelt upon the necessity of a correct knowledge of the fossils peculiar to each bed, as the only true means of identifying strata.

Mr. PARKINSON exhibited drawings of "Belas Knap" tumulus,—of the large long skulls of the most ancient race of men, from the round tumuli, —and a correct representation of a shepherd's hut near Ablington, supposed to have been an ancient British residence; and a neatly-drawn diagram of Bredon Hill, shewing the position of the round and long tumuli upon it, the situation of the sand, of the serrated flint flakes, and the course of the road, with the position and stratification of the gravel-bed; pointing out the relative position of the most ancient human evidences,—the human skulls, and the Roman horse-shoes, coins, and bone pins, together with the position on the Lias marls and mud in which the extinct mammalian remains were discovered.

Fine specimens were shewn of the horns of the *Bos longifrons*, from the silt and gravel of the Chelt, near the Old Wells, Cheltenham.

On the 14th September, the British Association for the advancement of Science met at Bath, under the presidency of Sir CHARLES LYELL, when the Cotteswold Club, in accordance with its programme, made Bath their place of meeting.

Your President, in association with the President of the Malvern Club, the Rev. W. S. SYMONDS, of Pendock, hired a large house in Pulteney Street, Bath, for the occasion; which became the centre for the members of both Field Clubs, who rallied round them on the occasion, a social circle of the most agreeable character, comprising among ladies and gentlemen of high social position and scientific eminence, many of the most distinguished members of the British Association, including their illustrious President, Sir CHARLES LYELL; Professor PHILLIPPS, (President elect;) Mr. LUBBOCK, F.R.S., and Mrs. LUBBOCK; Dr. HOOKER, F.R.S., and Mrs. HOOKER; Professor HARKNESS, F.R.S., and Miss HARKNESS; Sir WILLIAM JARDINE, F.R.S., and Miss JARDINE; Lord ENNISKILLEN, F.R.S.; The DEAN OF HEREFORD; Sir WILLOUGHBY JONES, and many others.

This field-club centre proved an extraordinary success, imparting a force and cohesion, which gave importance to an embodiment, the dis-severed elements of which had been previously capable of exercising but little influence, but, thus combined, affording support to the Association, from an entirely new quarter, the value of which was fully recognised.

It is proposed to perpetuate this institution, and with that view, Mr. SYMONDS and myself have already taken measures for securing accommodation at Birmingham, during the ensuing congress of the

British Association at that town, when we hope to make such arrangements as shall enable us to offer to those members of the Field Clubs who may attend the meeting, a centre of common resort, where they may find many elements of social comfort, as well as such friendly counsel and assistance, as, in a strange locality, is so greatly needed by casual visitors.

In conclusion, I have only to congratulate the Club upon its continued prosperity, which I trust will be fully sustained; and to thank you all for the kind confidence which you continue to repose in me, to which, and to the support I have received from our Secretary, and from each of our associates, I attribute any measure of success which may have attended my efforts to promote the well-being of the COTTESWOLD CLUB.

END OF VOL. III.

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